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RESULTS OF 1986 WATER QUALITY OBJECTIVES COMPLIANCE MONITORING INTERNATIONAL SAINT JOHN RIVER BASIN

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RESULTS OF 1986 WATER QUALITY OBJECTIVES COMPLIANCE MONITORING

INTERNATIONAL SAINT JOHN RIVER BASIN

IW/L-AR-WQB-87-131

D. M. Lockerbie

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ABSTRACT

This report compares the 1986 water quality data for the International Saint John River with the Water Quality Objectives for selected parameters. Data from grab sampling at eleven sites in the basin on five separate occasions are compared to the "safe" and "acute" objectives. Water temperature, dissolved oxygen (mg/L) and pH complied with both the "safe" and "acute" objectives. Median concentrations of total phosphorus and total dissolved phosphorus were all well below the recommended "safe" objective for water in flowing streams, although individual samples from most of the sites had total phosphorus and total dissolved phosphorus concentrations in excess of the 0.015 mg/L level which the State of Maine considers indicative of potential algal blooms. The median concentration of total phosphorus measured in samples collected from the Aroostook River at Tinker Dam exceeded the recommended "safe" objective for water in an impoundment. Median concentrations of extractable aluminum measured in samples collected from the Saint John River at St. Basile and at Grand Falls exceeded the recommended "safe" objective of 0.100 mg/L, but median concentrations of dissolved aluminum measured in samples from all the sampling sites were below the recommended "safe" objective of 0.100 mg/L.

Concentrations of extractable copper, lead, zinc and mercury were all well below the recommended "safe" objectives for these parameters.

RESUME

Dans ce rapport, les données recueillies en 1986 concernant la qualité des eaux internationales de la rivière Saint-Jean sont comparées aux objectifs de la qualité des eaux recommandés pour certains paramètres. Les données proviennent d'échantillons ponctuels qui ont été recueillis à onze stations dans ce bassin et en cinq occasions distinctes. Ces données sont comparées aux objectifs "sans danger" et "aigus" déjà établis. Les résultats de la température de l'eau, de l'oxygène dissous (mg/L) et du pH se conformaient tous avec les objectifs "sans danger" et "aigus" recommandés.

Les concentrations médianes en phosphore total et en phosphore dissous total se conformaient aux objectifs "sans danger" prescrits pour les cours d'eau. Cependant, certains échantillons provenant de la plupart des stations avaient des concentrations de phosphore total et de phosphore dissous total excèdent 0.015 mg/L, ce qui est le niveau de concentration considéré par l'Etat du Maine comme pouvant causer des floraisons d'algues. Les échantillons recueillis dans la rivière Aroostook au barrage Tinker avaient des concentrations médianes de phosphore total supérieures à l'objectif "sans danger" recommandé pour des eaux dans un endiguement.

Les concentrations médianes d'aluminium extractible mesurées dans des échantillons provenant de la rivière Saint-Jean à Saint-Basile et à Grand-Sault ont excédé l'objectif "sans danger" recommandé de 0.100 mg/L. Par contre, les concentrations médianes d'aluminium dissous mesurées dans des échantillons provenant de toutes les stations se conformaient à l'objectif "sans danger" recommandé.

Les concentrations de cuivre, de plomb, de zinc et de mercure extractibles dans l'eau échantillonnée étaient considérablement inférieures aux objectifs "sans danger" recommandés pour ces paramètres.

INTRODUCTION

The 120 km reach of the Saint John River from the St. Francis River to Grard Falls forms the International boundary between Canada and the U.S. In February 1975, use specific Water Quality Objectives for the international waters of the Saint John River were recommended for 61 parameters and a number of pesticides. Since then, these objectives have been revised and the recommended changes have been presented in the report of the International Technical Advisory Subcommittee on Water Quality in the Saint John River (ITAS, 1980). They have now been accepted by both governments as water quality goals to aim for in the management of water quality in the international Saint John River Basin.

The objectives are based on the fishable-swimmable criteria incorporated into United States legislation and agreed to by the Canada-U.S. Committee in 1975. They are a combination of Water Quality Objectives developed separately for fisheries and contact recreation uses. Generally, if the water quality is degraded to a level slightly worse than the recommended objective, a threat to one or more of the intended uses could be expected.

With each objective, two separate levels of quality were developed to support the fisheries or aquatic biota aspect. A single objective for the "safe level" represents the long-term management goal and should be compared to annual or seasonal

averages of monitoring data, and an alert or "acute" level identifies immediate problems within single grab samples. Table 1 lists the water quality parameters for which objectives have been established, the NAQUADAT Parameter Code, identifying the method(s) of measurement of each parameter, and the established "safe" and "acute" objective levels.

The Water Quality Branch presently monitors the international portion of the Saint John River and its tributaries on a regular basis to provide data for comparison with the established water quality objectives. Table 2 lists the locations of the eleven sites in the basin sampled in 1986, together with their corresponding NAQUADAT Station Nos. and abbreviated station numbers used in the graphs in this report.

Previous reports (Howell, 1984 and Lockerbie, 1984) have discussed the difficulties involved in inferring compliance/noncompliance with established water quality objectives utilizing low frequency grab-sampling techniques. For this reason, no rigorous interpretation of the data will be attempted. This report serves merely to document what has been accomplished during the 1986 year of monitoring for water quality objectives in the basin.

Methods

Grab samples were collected from eleven sites in the basin on six different occasions during the January 1/86 to December 31/86 period with the following seasonal distribution of sample collection.

Late February
Mid April
Late June
Late August
Mid November
Mid December

Because finalized laboratory data were not available for samples collected during the November and December samplings, data resulting from these samples are not included in this report.

In addition, in response to recommendations contained in the report by Howell, 1984, which noted that the three transboundary streams - Meduxnekeag, Big Presque Isle and Aroostook were being eutrophied based upon phosphorus concentrations, and should be investigated more intensively, an automatic water quality monitor (AWQM) was installed and operated on the Big Presque Isle Stream at Tracey Mills during the May 21 to September 11, 1986 period. The AWQM consisted of two measuring systems operating in parallel - a

Montedoro-Whitney custom built probe package and a modified Hydrolab 4000 series probe package measuring dissolved oxygen, pH, specific conductance, and water temperature.

The AWQM was also equipped with a Li-Cor light sensor to measure photosynthetically active radiation (PAR) at the site on an hourly basis.

Hourly data measured by the AWQM for the July 1 - August 31 period are also discussed in this report.

Additionally, data resulting from samples collected at Tracey Mills on a daily basis during the periods May 21 to July 7 and July 17 to September 3 using a Phillips auto-sampler are discussed. The daily samples were analyzed for total phosphorus (NAQUADAT Code 15413P), total nitrogen (NAQUADAT Code 07601L) and dissolved organic carbon (NAQUADAT Code 06107L).

Data resulting from the AWQM measuring systems was obtained in Moncton using a Labarge GOES satellite retransmission platform, and the data was stored on the Water Quality Branch VAX 750 minicomputer.

The AWQM probes were field calibrated using standard W.Q.B. field measurement procedures on July 16, 17, 30, 31, August 21 and

22, and data were adjusted assuming a linear shift between calibration points.

Samples for dissolved aluminum (NAQUADAT Codes 13102L and 13106L) and dissolved phosphorus (NAQUADAT Code 15104L) were filtered in a field laboratory located at Grand Falls within 6 hours of sample collection. Samples for dissolved aluminum were filtered through Millipore 0.45 μm membrane filters (HAWP 047 00) and those for dissolved phosphorus were filtered through Spectro Grade Coleman glass fiber filters. All samples requiring preservation were field preserved within 6 hours of sample collection.

Data analysis and graphing were performed on a VAX 11/750 mini-computer using the RS/1 software package. For purposes of graphing, parameter values reported as below the limit of detection of the analytical method were arbitrarily set to the absolute value of the detection limit.

Field quality control/assurance techniques were employed on a routine basis during the collection of samples in the basin during 1986 and are described in more detail in the report by Lockerbie, 1987. The analytical results of "field blanks" are included in Tables 3 and 4, and the results of sequential triplicate sampling are included in the graphs and data tables.

Results and Discussion

Tables 5 to 7 and figures 1 to 13 detail and summarize the analytical results of grab samples collected during 1986 monitoring for water quality objectives (Project Sub I.D. 0205) in the International Saint John River Basin.

Following is a summary of parameter value compliant/non-compliant status based upon comparison of the 1986 sampling data to the established water quality objectives.

Water Temperature

Table 5 and figure 1 list and summarize water temperature measurements made at the eleven sites in the basin when grab samples were collected. In addition, figure 14 shows daily mean, minimum and maximum water temperatures measured by the AWQM for the months of July and August in the Big Presque Isle Stream at Tracey Mills. All of the sites sampled were found to have water temperatures at the time of grab sampling below the not to exceed safe objective of 25°C. However, water temperatures are highly variable, with some of the smaller streams probably having daily water temperature variations closely following ambient air temperatures.

For this reason water temperature measurements made infrequently, such as when grab samples are collected, should not be used to infer compliance/non-compliance with the recommended temperature objectives.

This is aptly illustrated by figure 14, which indicates that water temperatures in the Big Presque Isle Stream at Tracey Mills often greatly exceed the summer maximum desirable objective of 20.0°C and on seven days during late July - early August, even exceeded the 25.0°C safe objective.

Dissolved Oxygen (mg/L)

Table 5 and Figure 2 list and summarize dissolved oxygen concentrations (mg/L) measured at the eleven grab sampling sites. None of the dissolved oxygen measurements made at the time of grab sample collection were below the 5.0 mg/L water quality objective for the basin.

However, figure 14 shows the daily mean, minimum and maximum dissolved oxygen concentrations of the hourly data recorded by the AWQM at Tracey Mills for July and August 1986. On several days in late July and early August, dissolved oxygen concentrations fell below the 5.0 mg/L water quality objective. However, the low dissolved oxygen excursions occurred only for brief periods during nighttime, when respiring phytoplankton and aquatic plants consume

oxygen, and the short duration of the non-compliant concentrations probably have no detrimental effects on fish or aquatic life.

The futility of using oxygen measurements made on a rather infrequent basis, such as when routine grab sampling is conducted, to compare with established objectives is vividly illustrated by the graph in Figure 14. While the Big Presquile Stream is admittedly probably the most highly variable in terms of oxygen concentrations, it is evident that, within one twenty-four hour period there can be greater than 100% variation and the daily mean concentration can vary by almost 100% from day to day.

Dissolved Oxygen (% Saturation)

Table 5 and figure 3 detail and summarize dissolved oxygen % saturation measured at the eleven sites when grab samples were collected in 1986.

In addition figure 15 depicts the daily mean, minimum and maximum % saturation of dissolved oxygen measured by the AWQM during July and August 1986 in the Big Presque Isle Stream at Tracey Mills.

One measurement made at the time of grab sample collection on March 25 (79.1%) in the Aroostook River at Tinker Dam was slightly below the lower safe objective of 80% saturation dissolved oxygen.

However, individual measurements made at several of the grab sampling sites exceed the upper safe objective of 110% saturation recommended for the basin. The most highly supersaturated oxygen value was measured in the Big Presque Isle Stream at Tracey Mills on June 23/86 (132.8%).

It is evident from figure 15 that dissolved oxygen often exceeds the upper safe objective of 110% saturation at this site. The marked supersaturation with dissolved oxygen at this site is attributable to photosynthetic activity in a highly productive system, and values as high as 400% saturation were measured at this site in mid-July.

The stream bed of the Big Presque Isle has a very gentle vertical gradient with gentle riffles interspersed with shallow, quiet pools, and it is surmised that the marked supersaturation with dissolved oxygen measured at the AWQM site at Tracey Mills is in part due to the location of the measuring sensor in the nearly standing water of a pool. During day-light the rapid photosynthetic production of oxygen by phytoplankton and aquatic plants results in the establishment of non-equilibrium conditions with regards to oxygen saturation. Since mixing by turbulence is minimal, the increase of oxygen can only be given off by a slow diffusion across the air water interface.

It is not known what the implications of this highly supersaturated oxygen water is for fish life, although no problems with gas-bubble disease in fish from this stream have been reported. Perhaps the upper safe objective of 110% saturation with dissolved oxygen for this stream should be further investigated with a view to shifting it upwards.

pH

Table 5 and figure 4 detail and summarize the pH of grab samples collected at the eleven sampling stations during 1986. No sample exceeded the upper safe objective of 9.0 or fell below the lower safe objective of 6.0. All samples were well below the upper acute limit for pH (9.8) and well above the lower acute limit for pH (4.2). The highest pH levels were measured in grab samples collected from the transboundary streams - Meduxnekeag, Big Presque Isle and Limestone, where maximum pH levels of 8.2, 8.3 and 8.3 respectively were measured.

Figure 16 shows the daily mean and range of pH measured on an hourly basis at the Tracey Mills site. It is evident that daily pH usually varied between 8 and 9 during this two month period, although there were three days in late July-early August when pH slightly exceeded the upper safe objective of 9.0.

Large diurnal fluctuations in both carbon dioxide and pH are characteristic of highly productive streams such as the Big Presque Isle. The uptake and release of CO_2 alters the buffer mixture and disturbs the equilibrium. Photosynthesis enters into the economy of waters by removing CO_2 and releasing an equal volume of oxygen. Initially the free CO_2 in solution is used up, and then the supply of CO_2 in the bicarbonate is available to aquatic plants for photosynthesis. True aquatic plants take up HCO_3^- ions from the dissociation of calcium bicarbonate and substitute OH^- ions for these. Bicarbonate is actively broken down, leaving only $CaCO_3$ remaining. The process does not stop when all the bicarbonate is broken down, but continues with hydrolysis of $CaCO_3$, yielding HCO_3^- ions which can then be exchanged against OH^- ions.

$$CaCO_3 + H_2O \rightarrow Ca^{++} + HCO_3^+ + OH^-$$
$$Ca^{++} + 2HCO_3^- \rightarrow Ca(OH)_2 + 2CO_2$$

The formation of calcium hydroxide results in a marked increase in pH.

At night, photosynthesis stops and respiration of the plants returns CO_2 to the water, decreasing the pH.

Figure 17 shows the diurnal variation in dissolved oxygen and pH measured at the Tracey Mills site between midnight August 23 and 0600 hrs August 24. The diurnal curves show the wide ranging

dissolved oxygen concentrations and pH values which can occur at this station in one twenty-four hour period. Dissolved oxygen concentrations ranged from 74% saturation (below the water quality objective of 80%) during darkness to a peak concentration of 124% saturation during daylight hours.

The pH values ranged from a low of 7.9 during night-time to a high of 8.8 in the daylight.

The high daily variability of these parameters at this site show the degree of error which can be introduced by utilizing infrequent grab sampling techniques to determine compliance/non-compliance with water quality objectives.

Total Phosphorus

Table 7 and figure 5 detail and summarize total phosphorus concentrations measured in grab samples collected at the eleven sites in 1986.

Additionally, figures 18 and 19 show the concentrations of total phosphorus measured in daily samples from the auto-sampler at Tracey Mills during the periods May 21 to July 7 and July 17 to September 2, 1986, respectively. Also shown on figures 14 and 15 is the daily mean $\pm$ standard deviation of stream discharge (cms)

derived from hourly discharge data at the Tracey Mills site for the days when samples were collected for analysis for total phosphorus.

One grab sample from each of the Green River and Big Presque Isle sampling sites reached or exceeded the safe objective for total phosphorus in flowing water (0.100 mg/L).

Phosphorus has a high affinity for adsorption on sediment particles, and the high levels measured in individual samples from both of these sites can probably be attributed to run-off from agricultural land. In the case of Green River, the high value (0.230 mg/L) was measured in a sample collected on April 22 when stream discharge was high due to spring run-off, and suspended solids levels were elevated (61.0 mg/L).

In the case of the Big Presque Isle Stream, the high total phosphorus concentration (0.100 mg/L) was measured in a sample collected by the auto-sampler at Tracey Mills on August 26, coinciding with a rapidly changing hydrograph, presumably caused by a summer rainstorm.

As indicated by figure 19, two samples were collected at the Tracey Mills site on August 25, 1986 - one by the Phillips auto-sampler and one grab sample collected manually using regular W.Q.B. sampling techniques. Interestingly, the concentration of total phosphorus (0.029 mg/L) measured in the grab sample is more

than double the concentration measured in the sample collected by the auto-sampler. Furthermore, the concentration of total phosphorus (0.100 mg/L) measured in a sample collected by the auto-sampler on the following day (August 26) was an order of magnitude higher than the concentration measured in the sample collected on August 25. Samples collected on August 25 and August 26 coincide with a peak on the hydrograph (figure 19) presumably resulting from a summer rain-storm. The discrepancy in concentration of total phosphorus measured in samples collected on August 25 probably indicates the inability of single grab samples, especially where total phosphorus is concerned, to adequately characterize a heterogeneous water mass.

In an effort to determine if there were any trends in total phosphorus concentrations in the Big Presque Isle River during the summer of 1986, the data resulting from daily samples was smoothed using the lowess (locally weighted regression scatter plot smoothing) procedure of the RS1 Software Package. Lowess employs weighted least squares, a statistical method suitable for fitting a line to a set of points on a scatter plot.

From figures 20 and 21 it is evident that total phosphorus concentrations reached a peak of 0.060 mg/l near the end of July. From then on total phosphorus concentrations declined, with some pertubations in this trend probably caused by run-off resulting from summer rainstorms.

It is evident from figure 18 that the total phosphorus-stream discharge relationship for this station is not well defined. Generally, during the spring runoff early summer period, there is an inverse relationship between total phosphorus concentrations and stream discharge in the Big Presque Isle, but during mid-summer total phosphorus concentrations often increase rapidly in response to peaks on the daily hydrograph. Presumably these increases in total phosphorus concentrations result from increased suspended matter from agricultural runoff during summer rainstorms in the basin, with phosphorus having an affinity for attachment to suspended matter.

Although there are no established water quality objectives for total nitrogen and dissolved organic carbon in the basin, these parameters were also measured in samples collected by the auto-sampler at the Tracey Mills site in an effort to determine if other nutrients behave in the same fashion as total phosphorus.

Figures 22 and 23 indicate concentrations of total nitrogen (parameter code 07601L) measured in daily samples collected from the Big Presque Isle Stream at Tracey Mills during the May 21 to July 7 and July 17 to September 3 periods respectively. Again, the daily sample concentrations were smoothed using the lowess procedure of the RS1 software package to indicate trends in the summer total nitrogen concentrations (solid line on graphs). The raw analytical data resulting from these samples is also listed in

Table 7. Although total nitrogen concentrations do not vary as widely in the daily samples, they do behave in much the same fashion over the summer months as does total phosphorus. During spring runoff and early summer (up to mid June) there is an inverse relationship between total nitrogen concentrations and stream-discharge, but during mid to late summer total nitrogen concentrations relate directly to peaks on the daily hydrograph. This trend would tend to indicate that the sources of total phosphorus and total nitrogen are one and the same in the Big Presque Isle - probably non-point agricultural land runoff.

Figures 24 and 25 indicate concentrations of dissolved organic carbon (parameter code 06107L) measured in the daily samples collected from the Big Presque Isle Stream at Tracey Mills during the May 21 to July 7 and July 17 to September 3 periods respectively. The raw analytical data resulting from these samples is also included in Table 7. The daily sample concentrations were also smoothed using the lowess procedure and the smoothed concentrations are also indicated as solid lines on the graphs.

Dissolved organic carbon concentrations behaved differently than total phosphorus or total nitrogen concentrations in the Big Presque Isle over the summer period. During the entire sampling period, dissolved organic carbon concentrations are directly related to stream-discharge at this site. Dissolved organic carbon concentrations peak in late May, corresponding to a spring runoff

peak on the daily hydrograph, although the concentration reached (8 mg/L)) is not as high as concentrations reached in August (12 mg/L) corresponding to a summer rain-storm peak on the daily hydrograph.

The different behavior of dissolved organic carbon concentrations in the Big Presque Isle over the summer period, i.e. its strong relationship with stream-discharge, probably indicates that dissolved organic carbon sources are different from those of total nitrogen and total phosphorus in the sub basin.

Dissolved Total Phosphorus

The tendency of phosphorus to associate with suspended solids in natural waters makes it difficult to interpret the total phosphorus measurement as an indicator of water quality. The high levels of total phosphorus found in individual grab samples can generally be attributed to high run-off events in the river basin when samples were collected. Much of this total phosphorus may be associated with organic matter and clays, and hence would not be available for primary production. Concentrations of <u>dissolved</u> total phosphorus are a better indicator of potential eutrophication in a water body, and table 7 and figure 6 list and summarize the <u>dissolved</u> total phosphorus concentrations measured at the eleven sampling stations in the basin.

Figure 6 shows dissolved total phosphorus concentrations measured in samples collected from eleven sites in the basin, and it is apparent that the dissolved component of total phosphorus is much lower than total phosphorus concentrations.

The dissolved phosphorus concentration in a sample taken from the Green River when total phosphorus concentration was 0.230 mg/L was 0.007 mg/L and in a sample taken from the Big Presque Isle Stream when total phosphorus concentration was 0.029 mg/L was 0.012 mg/L.

Dissolved total phosphorus concentrations exceeded the 0.015 mg/L recommended water quality objective for prevention of the possible development of nuisance conditions (potential algal bloom level) at four of the sampling locations.

- Saint John River at St. Basile
- Saint John River at Edmundston-Madawaska Bridge
- Limestone Stream at Four Falls
- Aroostook River at Tinker Dam

Aluminum

The safe level for extractable aluminum was established because many of the salts of aluminum are soluble, and neutral and anionic precipitates of aluminum are toxic to fish. At a pH of 7.0

or above, the safe level is 0.100 mg/L as total extractable aluminum. As mentioned earlier in this report, the Saint John River and its International tributaries always has a pH above 6.0 and usually above 7.0. This is within the range of minimum solubility of aluminum.

Extractable Aluminum

At least one sample from all of the sites sampled, with the exception of the St. Francis River, exceeded the recommended safe objective of 0.100 mg/L.

The acute limit is between 1.0 and 5.0 mg/L as total dissolved aluminum, a level which was not even approached in samples collected in 1986 (Fig. 9).

Generally the concentration of total dissolved aluminum is much lower than that of extractable aluminum. Figures 26 to 29 show the relationship between the dissolved portion of aluminum vs the concentration of extractable aluminum at four of the sampling sites in the basin. Dissolved aluminum concentrations vary from 3 to 100% of extractable aluminum concentrations. Usually when extractable aluminum concentrations exceed the 0.100 mg/L safe level, the dissolved portion makes up less than 60% of the extractable aluminum concentration.

Figures 30 to 37 show the relationships between both total dissolved aluminum and extractable aluminum concentrations and dissolved organic carbon (DOC), water colour, turbidity and non-filterable residue for data resulting from all samples collected in the basin in 1986.

Figure 32 shows the fairly strong linear relationship between total dissolved aluminum concentrations and water colour (r^2=0.728) while figure 30 indicates that total dissolved aluminum concentrations are also (although less strongly - r^2=0.575) related to DOC concentrations. Not surprisingly, there is little relationship between total dissolved aluminum concentrations and turbidity levels (figure 34) or suspended solids (non-filterable residue) concentrations in the samples (figure 36).

In contrast, total extractable aluminum concentrations correlate rather poorly with water colour (figure 33), and DOC (figure 31), although the higher concentrations are sometimes associated with high levels of suspended solids (figure 37) and thus higher turbidity (figure 35).

The strong relationship between total dissolved aluminum concentrations and water colour, and to a lesser extent with DOC probably indicates that it occurs as an organic complex, a form which is much less toxic and available to the biota. Howell (1985) also noted a fairly strong relationship between total dissolved

aluminum concentrations and DOC in the International Saint John Basin.

Extractable Copper

No sites sampled had copper concentrations above the recommended safe objective of 0.005 mg/L

Extractable Lead

No sites sampled had lead concentrations above the recommended safe objective of 0.005 mg/L

Extractable Zinc

No sites sampled had zinc concentrations above the recommended safe objective of 0.030 mg/L

Extractable Mercury

No sites sampled had mercury concentrations above the recommended safe objective of 0.064 ug/L.

Recommendations

It is evident that trace metal concentrations are well below the safe objectives recommended for the basin, while phosphorus levels, particularly in the trans-boundary tributaries, approach or exceed the water quality objectives established to prevent eutrophication.

A redirection of monitoring resources to a more thorough investigation of nutrient loading and dynamics (phosphorus, nitrogen and carbon) in the three international trans-boundary streams - Meduxnekeag, Big Presque Isle and Aroostook, would seem to be warranted.

REFERENCES

Anonymous, 1983. Sampling for Water Quality, Environment Canada, Ottawa.

Anonymous, 1986. NAQUADAT Dictionary of Parameter Codes, Environment Canada, Ottawa.

Howell, G., 1984. Compliance of Selected Water Quality Parameters to the Objectives of the International Waters of the Saint John River Basin During the Years 1982 and 1983. Water Quality Branch, Inland Waters Directorate (IWD-AR-WQB-84-56), March 1984, 30 p.

Howell, G., 1985. Results of the 1984/85 Monitoring of the Saint John River, N.B., Water Quality Branch, Atlantic Region, Inland Waters Directorate (IWD-AR-WQB-85-77), March, 1987. 72 p.

ITAS, 1980. Review and update of Water Quality Objectives for the International Waters of the Saint John River Basin. A report of the International Technical Advisory Sub-Committee on Water Quality in the Saint John River, September 1980. 61 p.

Lockerbie, D., 1987. Compliance of Selected Water Quality Parameters to the Objectives of the International Waters of the Saint John River Basin During the Years 1984 and 1985. Water Quality Branch, Atlantic Region, Inland Waters Directorate (IW/L-AR-WQB-87-118), January, 1987. 77 p.

Ruttner, F., 1963. Fundamentals of Limnology. University of Toronto Press, Toronto, Canada.

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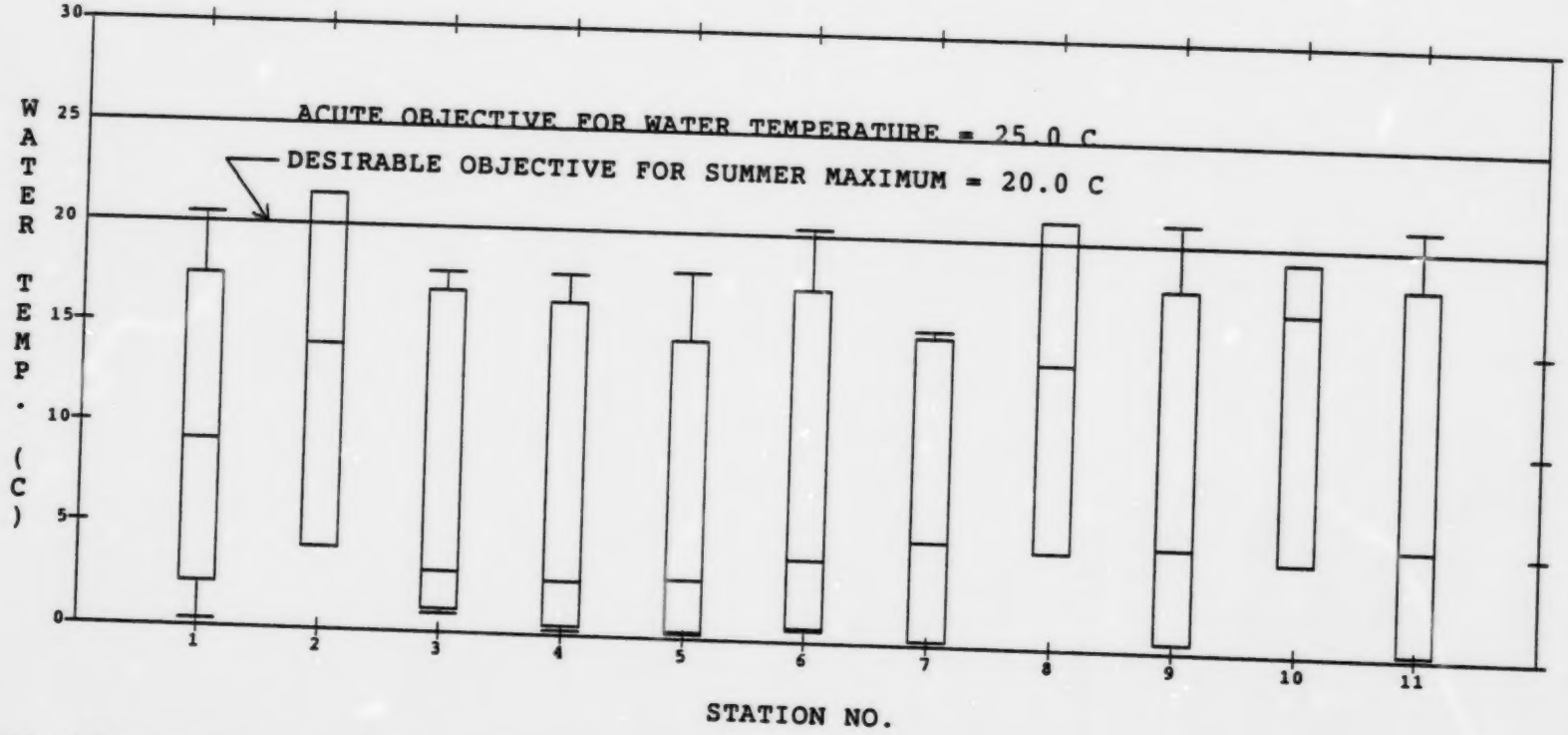
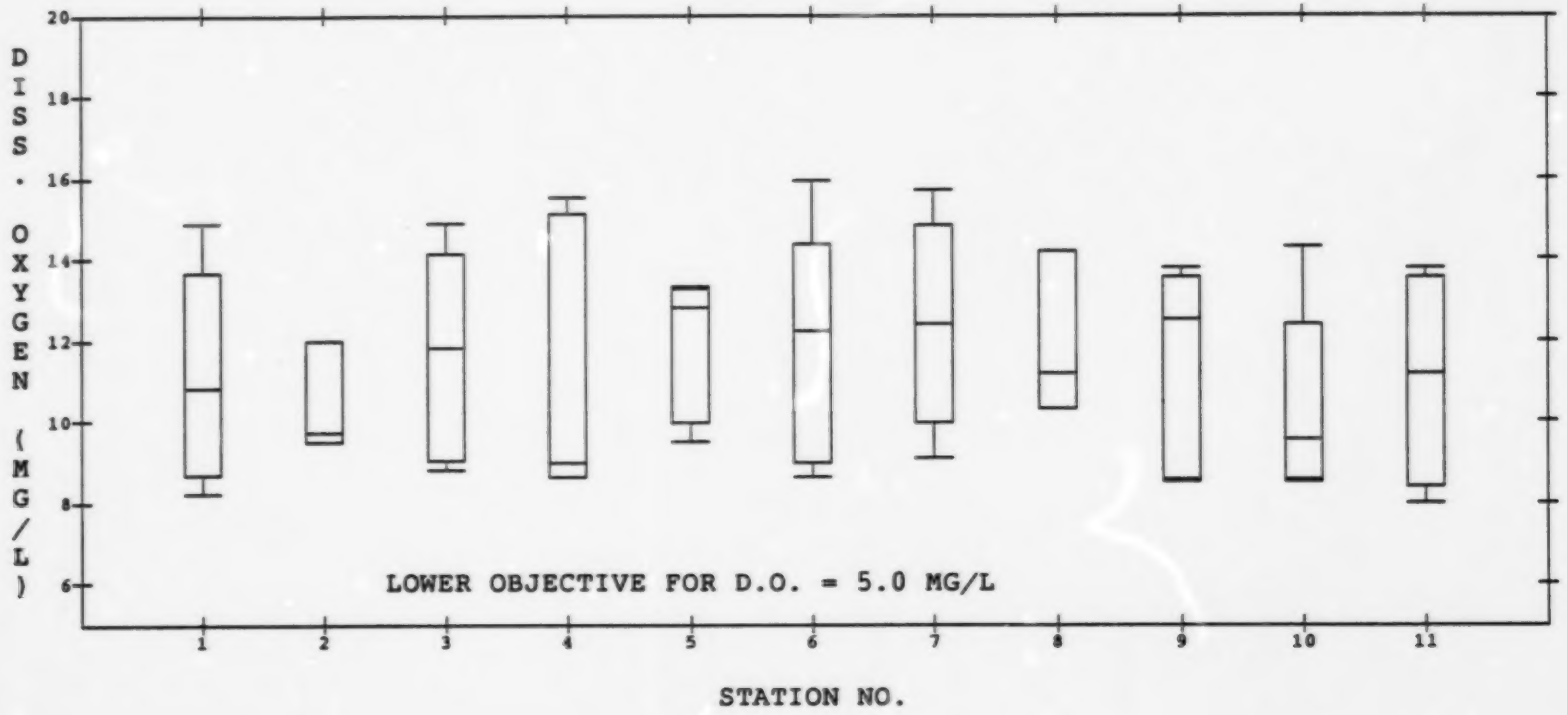
FIG. 1
WATER TEMPERATURE (C) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.



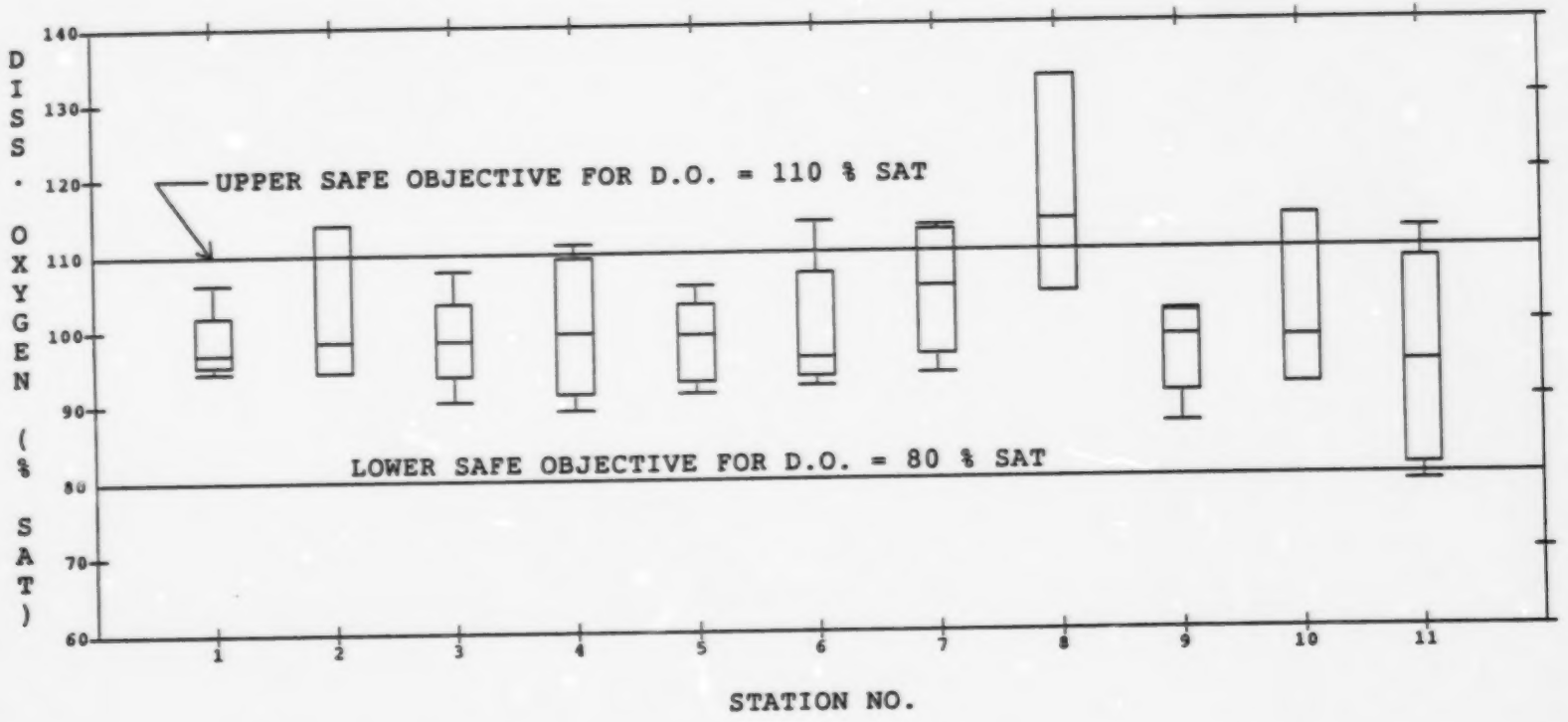
Of fifty water temperature measurements made in the basin in 1986, the maximum was 21.5 C in the Saint John River at Edmundston - Madawaska bridge.

FIG. 2
DISSOLVED OXYGEN (MG/L) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.



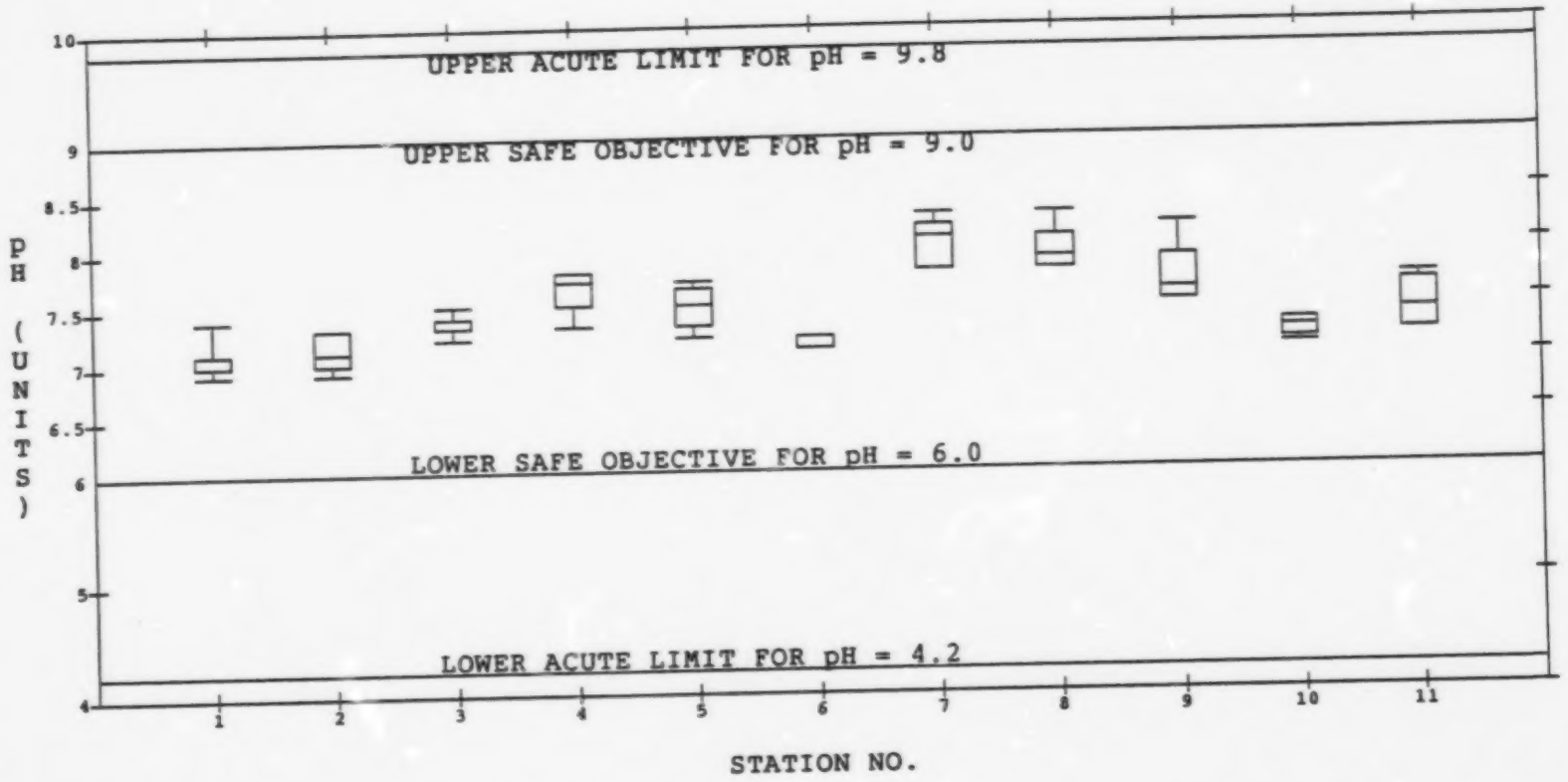
Of forty eight dissolved oxygen measurements made in the basin in 1986, the minimum concentration measured was 8.0 mg/l in the Aroostook River at Tinker Dam.

FIG. 3
DISSOLVED OXYGEN (% SATURATION) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.



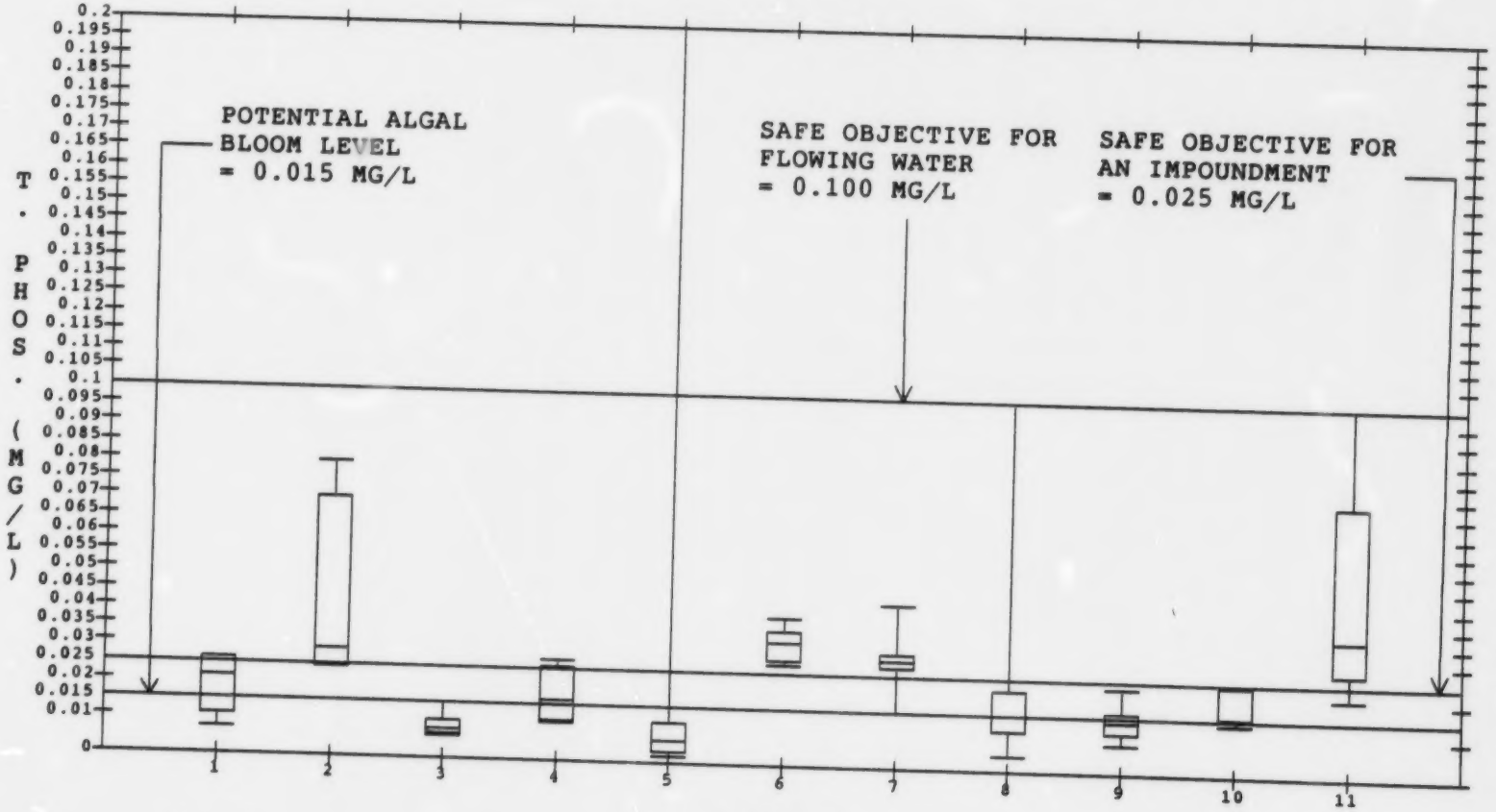
Of forty eight dissolved oxygen measurements made in the basin in 1986, the minimum concentration measured was 79.1 % saturation in Aroostook River at Tinker Dam.

FIG. 4
LAB MEASURED pH (UNITS) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.



Sixty nine pH measurements made on samples
collected from the basin in 1986 ranged from 6.9 to 8.3

FIG. 5
TOTAL PHOSPHORUS (MG/L) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.



INCLUDES DATA FROM SAMPLES
COLLECTED BY AUTO-SAMPLER AT
STATION NO 8.

FIG. 6
DISSOLVED TOTAL PHOSPHORUS (MG/L) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.

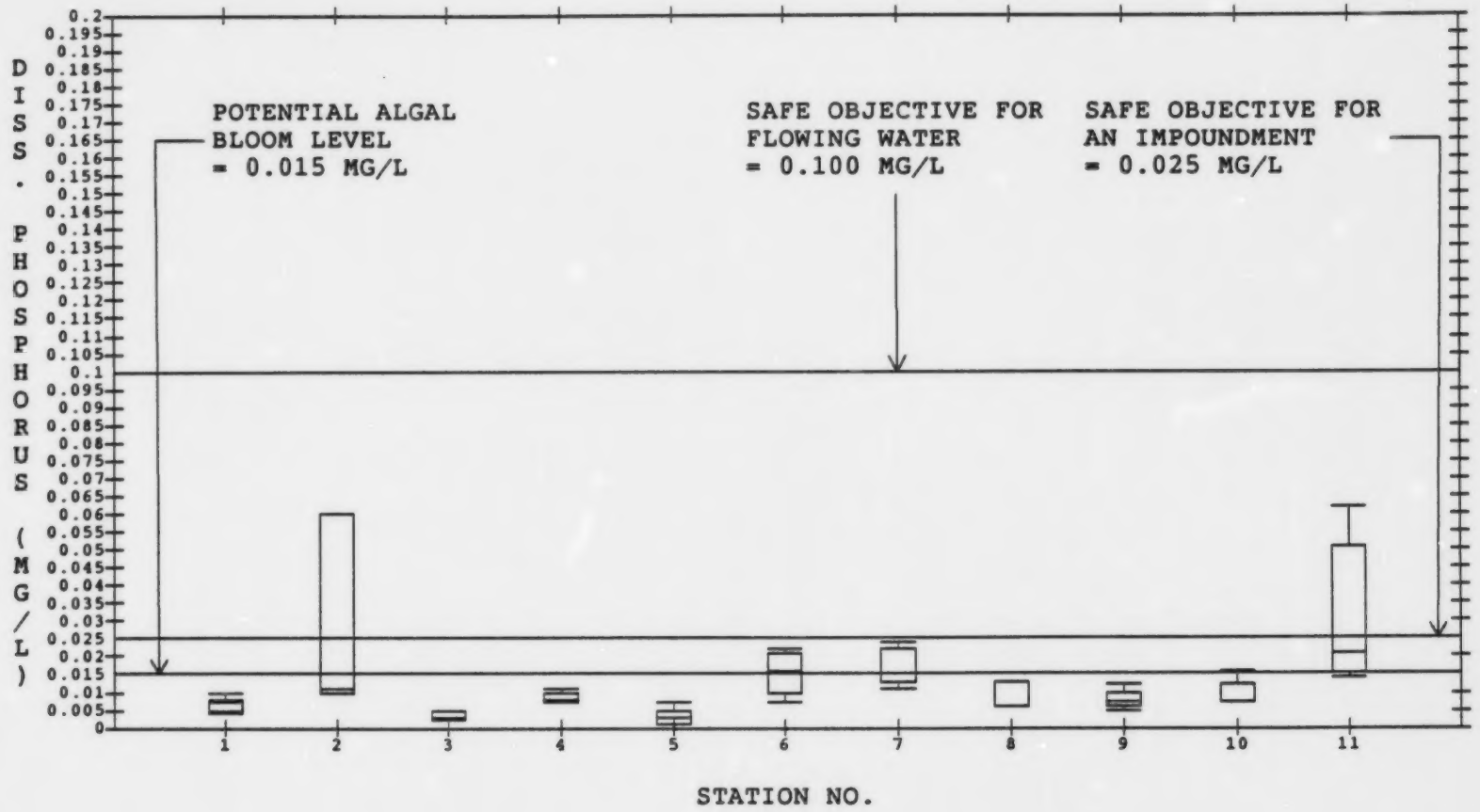


FIG. 7
NON-FILTERABLE RESIDUE (MG/L) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.

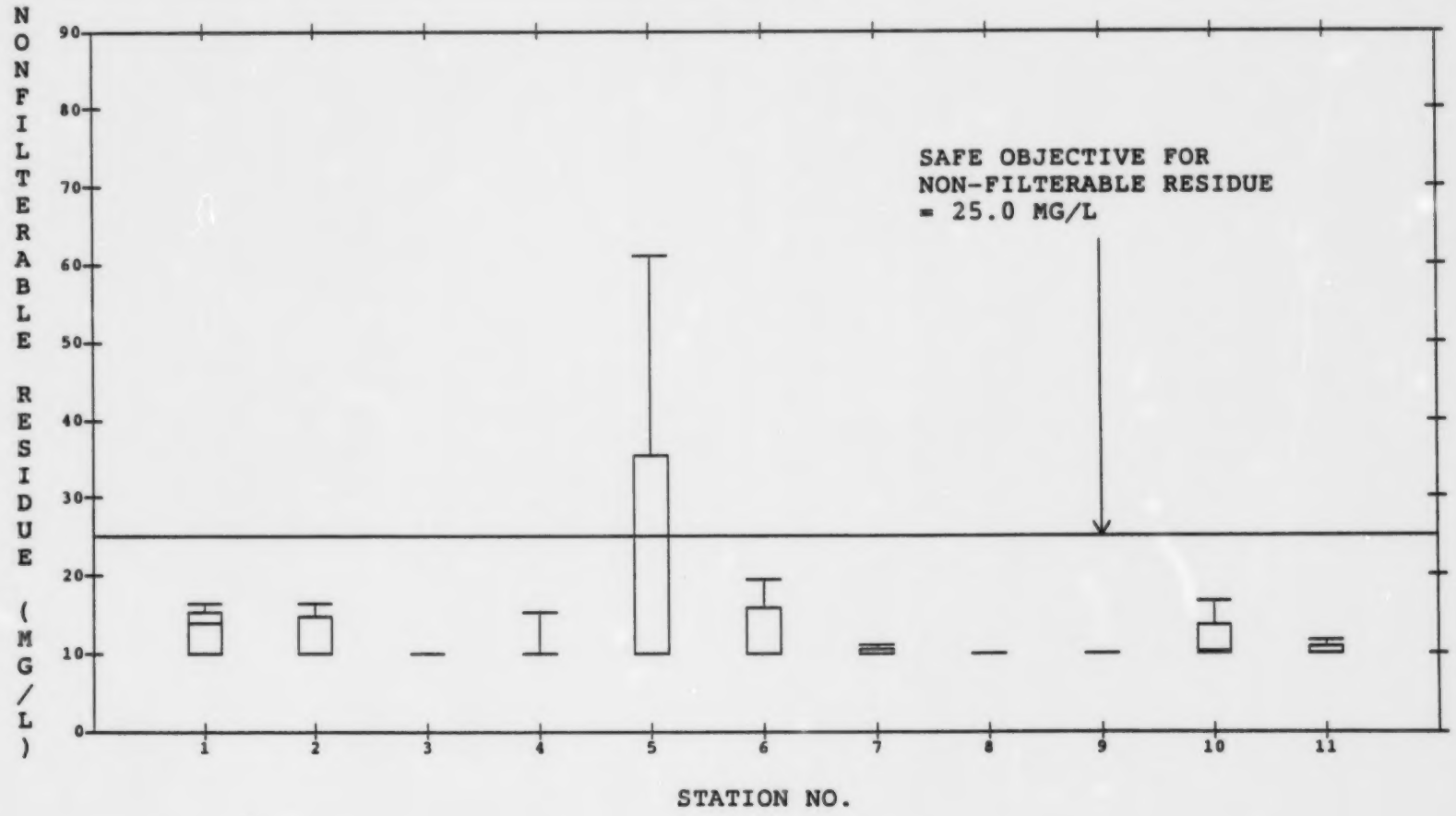


FIG. 8
EXTRACTABLE ALUMINUM (MG/L) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.

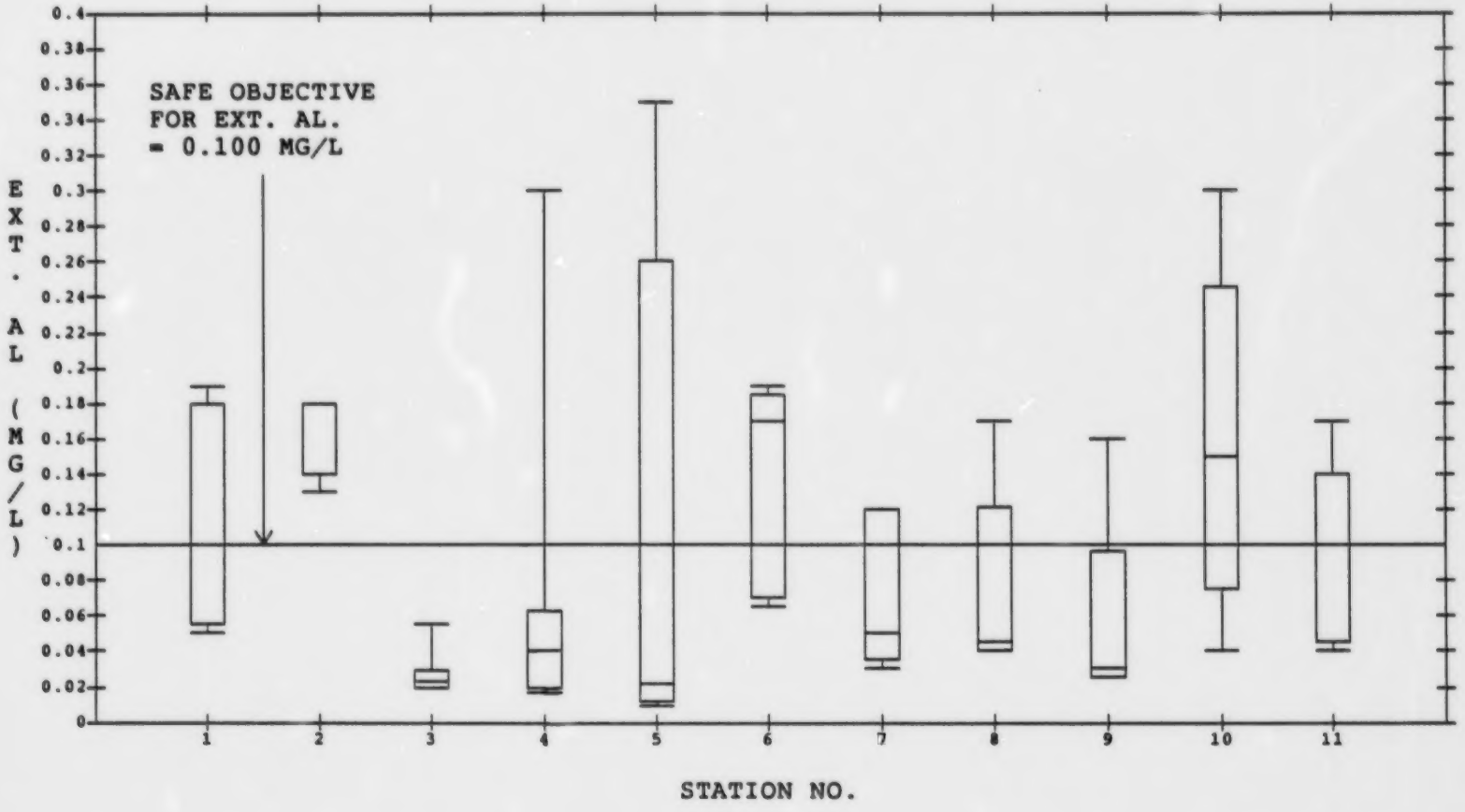


FIG. 9
DISSOLVED ALUMINUM (MG/L) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.

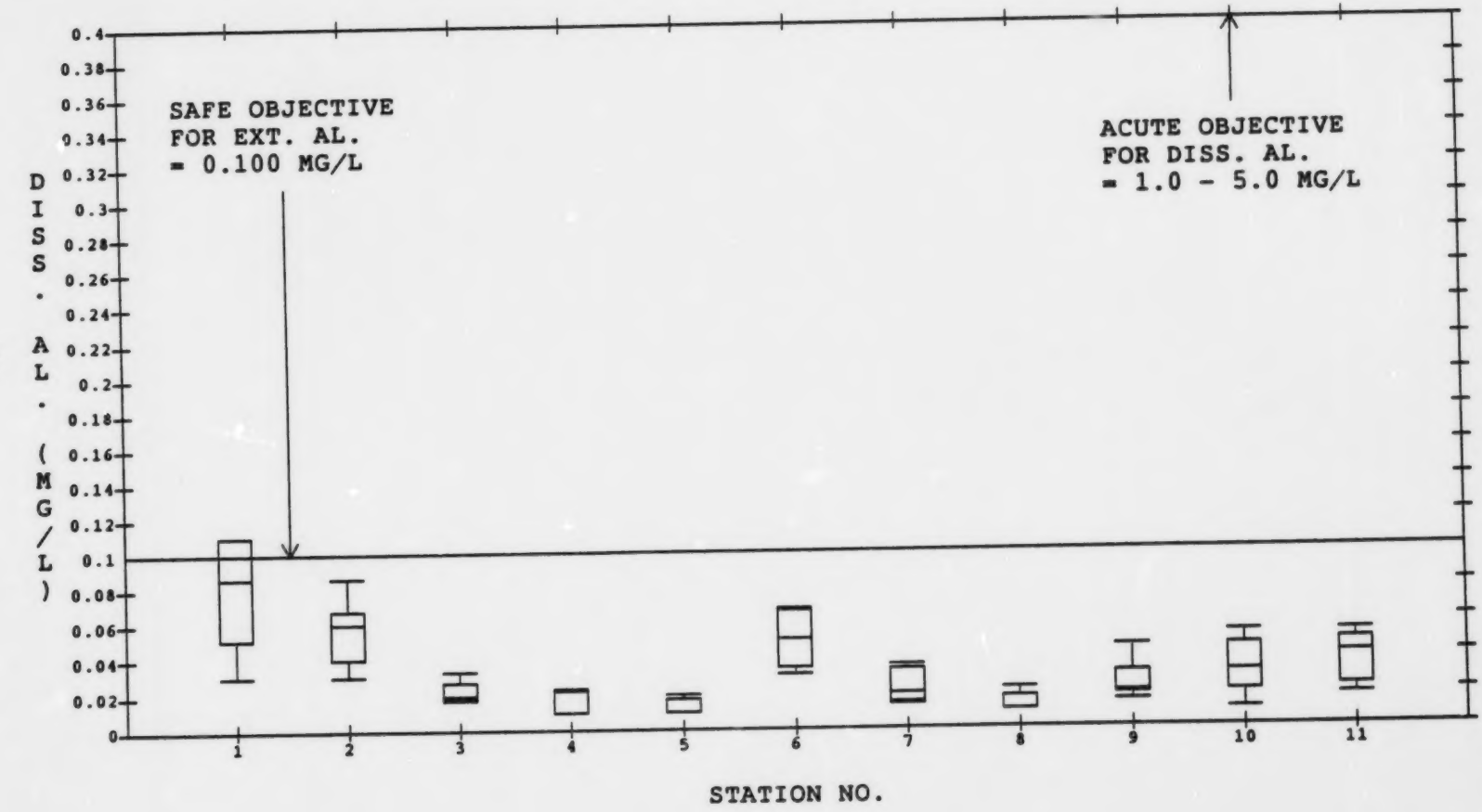
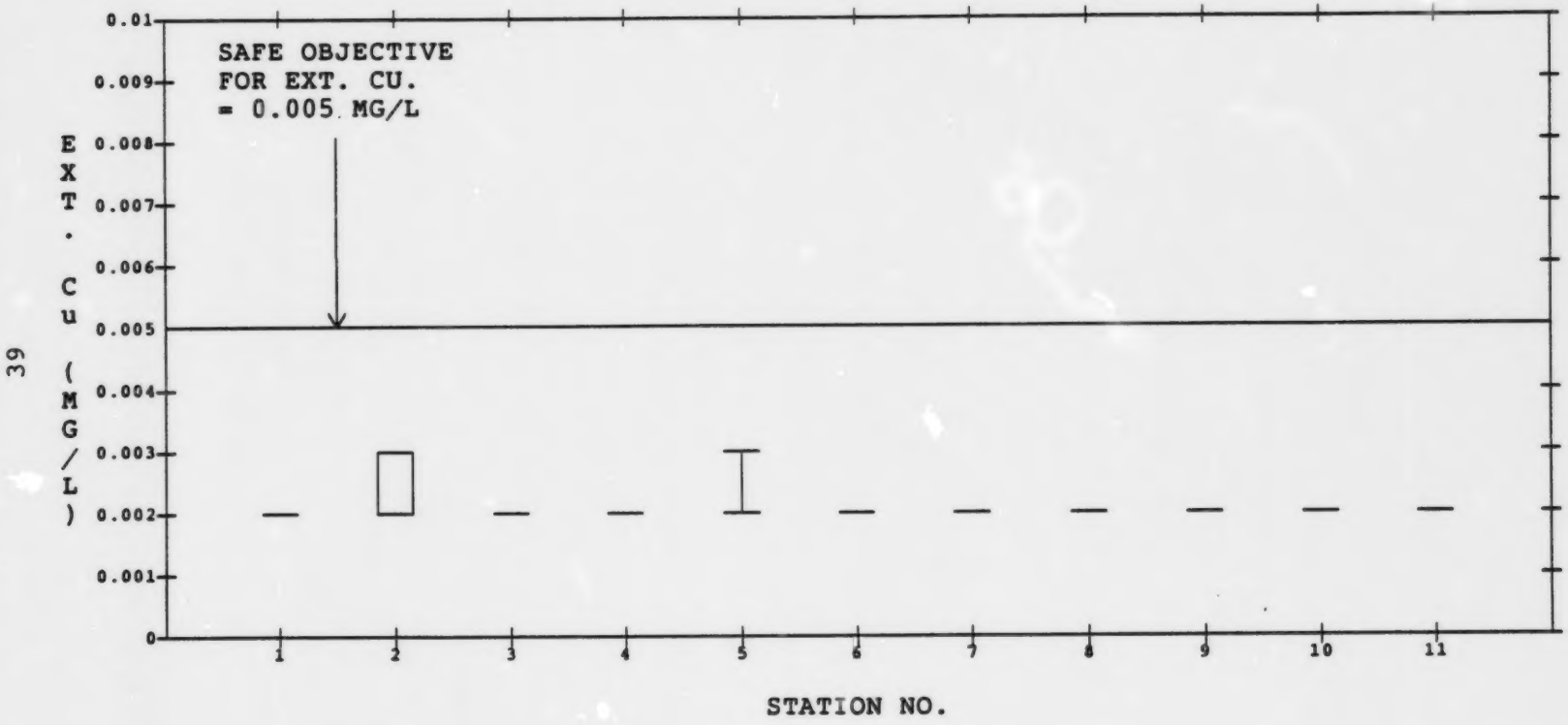
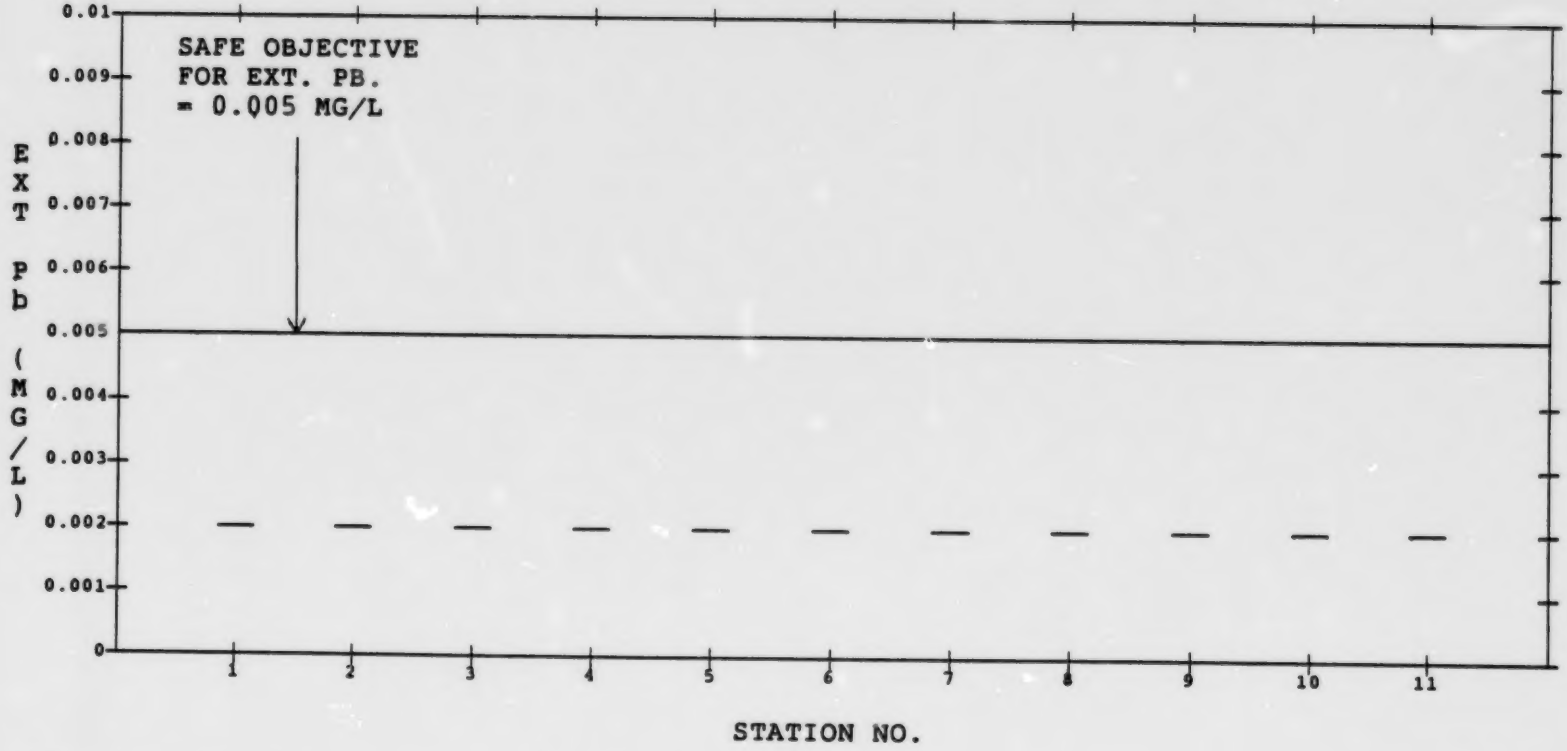


FIG. 10
EXTRACTABLE COPPER (MG/L) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.



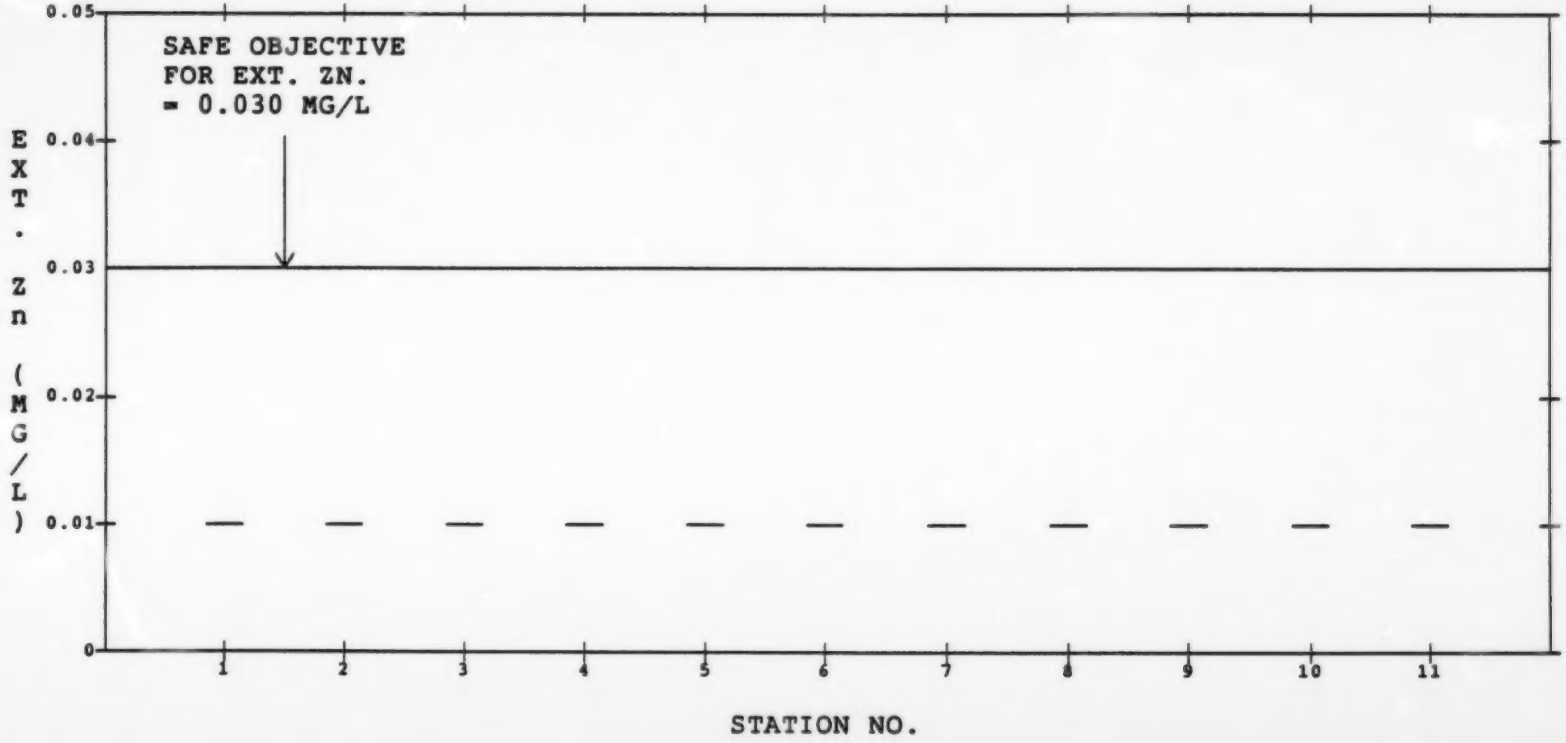
NOTE: Analytical results reported as
"less than detection limit" were assigned
absolute value of detection limit - 0.002 mg/l.

FIG. 11
EXTRACTABLE LEAD (MG/L) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.



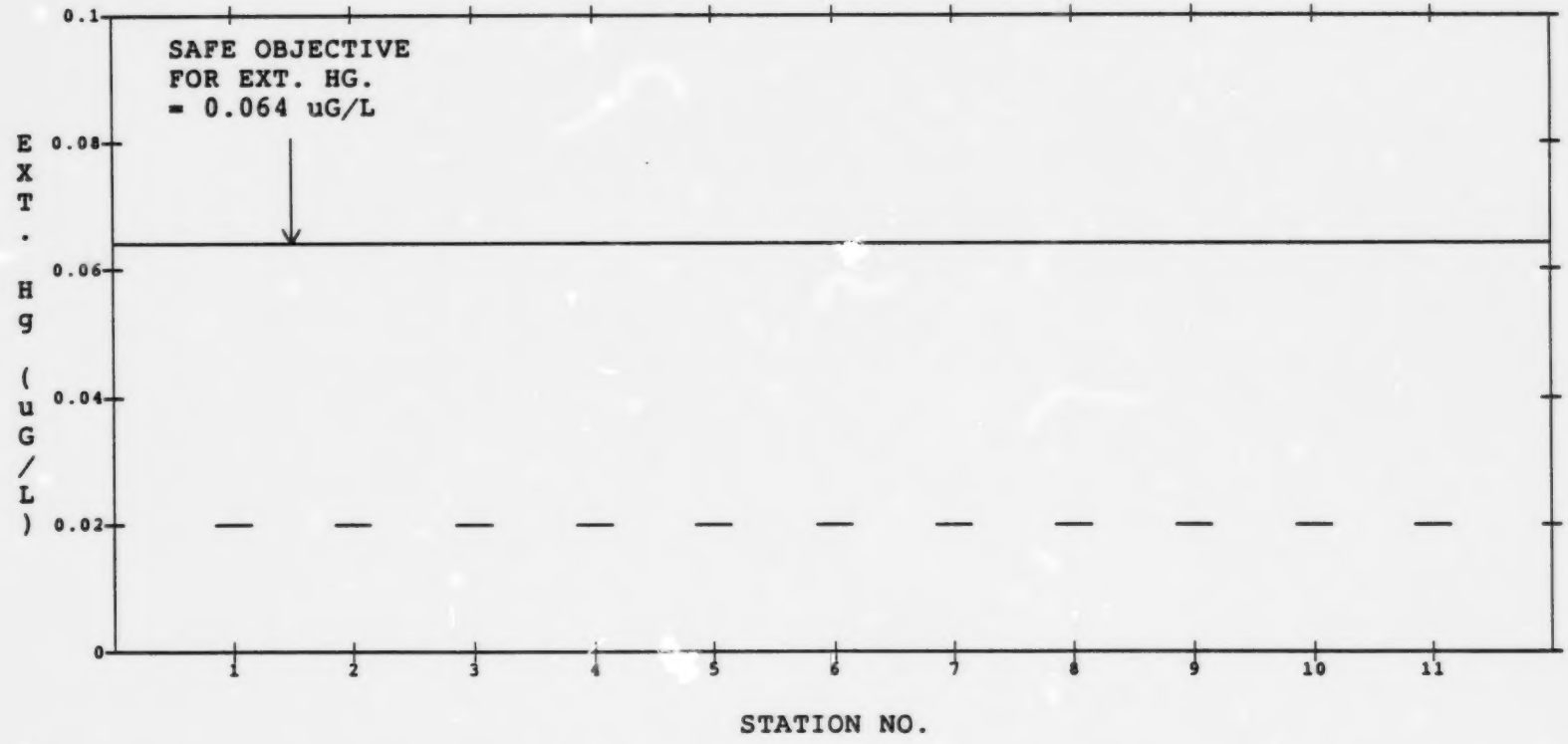
NOTE: Analytical results reported as
"less than detection limit" were assigned the
absolute value of the detection limit - 0.002 mg/l.

FIG. 12
EXTRACTABLE ZINC (MG/L) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.



NOTE: Analytical results reported as
"less than detection limit" were assigned the
absolute value of the detection limit - 0.010 mg/l.

FIG. 13
EXTRACTABLE MERCURY (uG/L) AT ELEVEN STATIONS
IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.



NOTE: Analytical results reported as
"less than detection limit" were assigned the
absolute value of the detection limit - 0.02 uG/L.

FIG. 14
DAILY MEAN, MINIMUM AND MAXIMUM
DISSOLVED OXYGEN (MG/L) AND WATER TEMPERATURE (C)
IN BIG PRESQUE ISLE STREAM AT TRACEY MILLS
JULY 1 TO AUGUST 31, 1986.

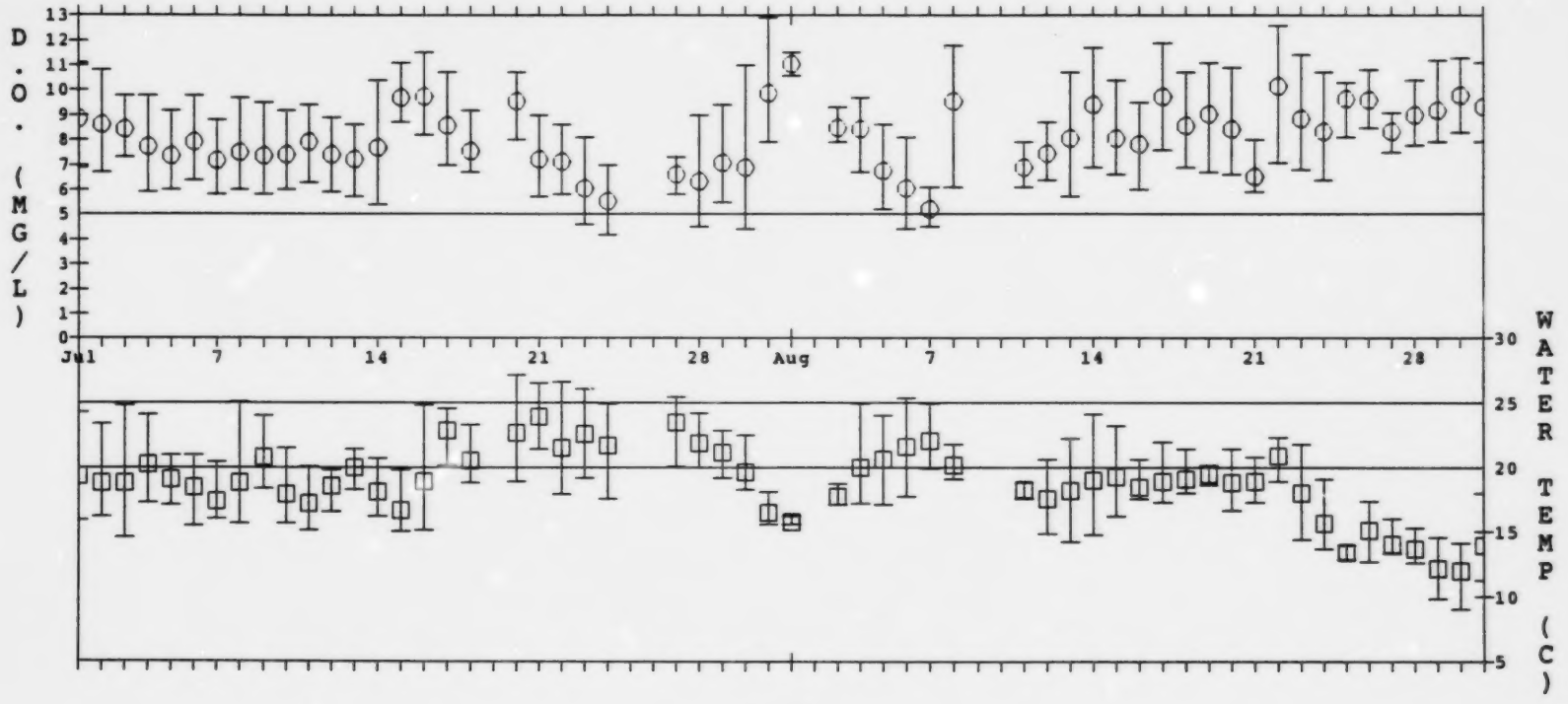


FIG. 15
DAILY MEAN, MINIMUM AND MAXIMUM
DISSOLVED OXYGEN (% SAT)
IN BIG PRESQUE ISLE STREAM AT TRACEY MILLS
JULY 1 TO AUGUST 31, 1986.

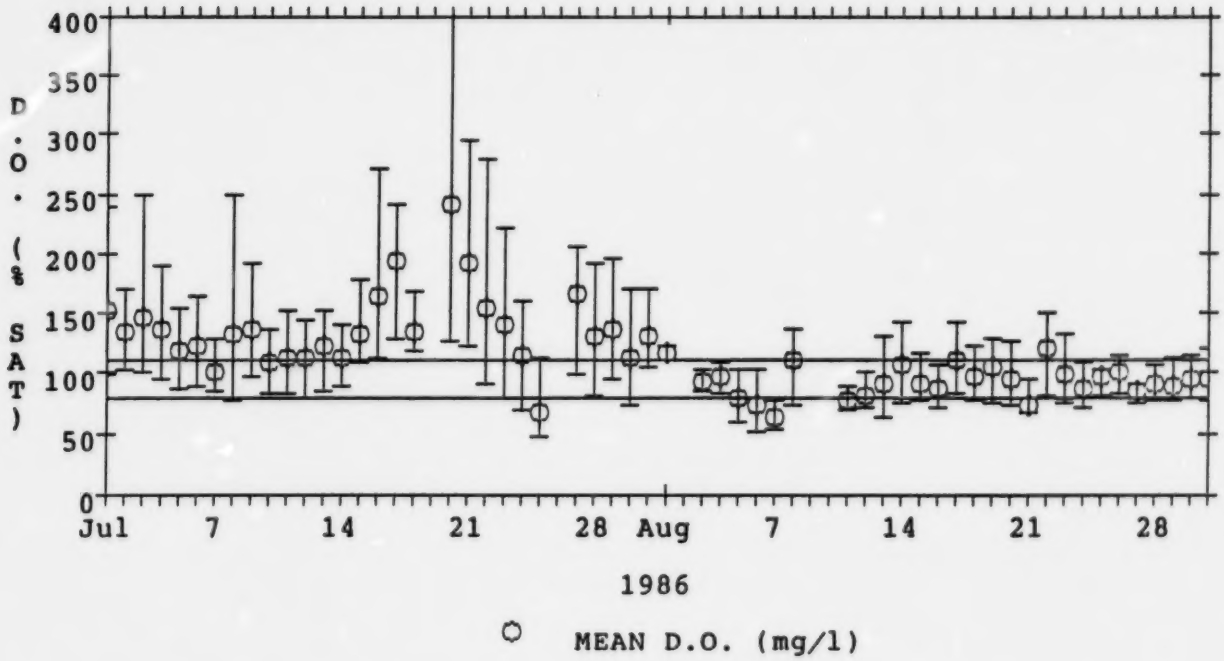


FIG. 16
DAILY MEAN, MINIMUM AND MAXIMUM pH (UNITS)
IN BIG PRESQUE ISLE STREAM AT TRACEY MILLS
JULY 1 TO AUGUST 31, 1986.

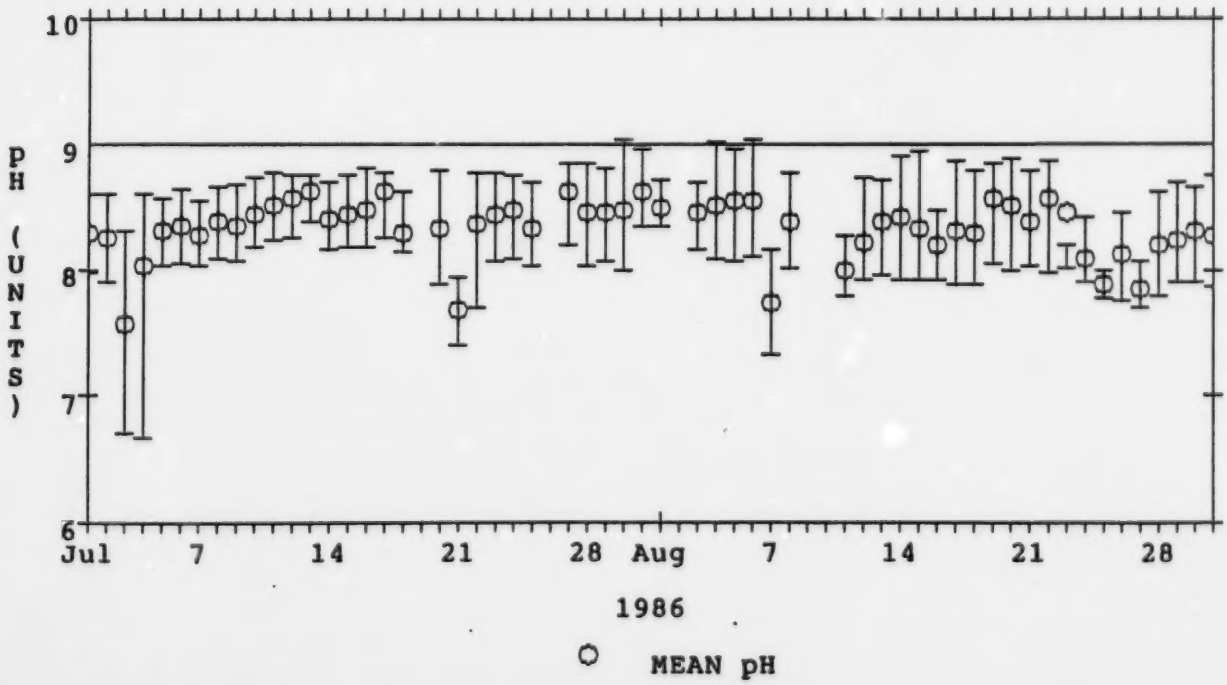


FIG. 17
DIURNAL VARIATION OF DISSOLVED OXYGEN (% SAT) AND pH (UNITS)
IN BIG PRESQUE ISLE STREAM AT TRACEY MILLS
AUGUST 23 TO AUGUST 24, 1986.

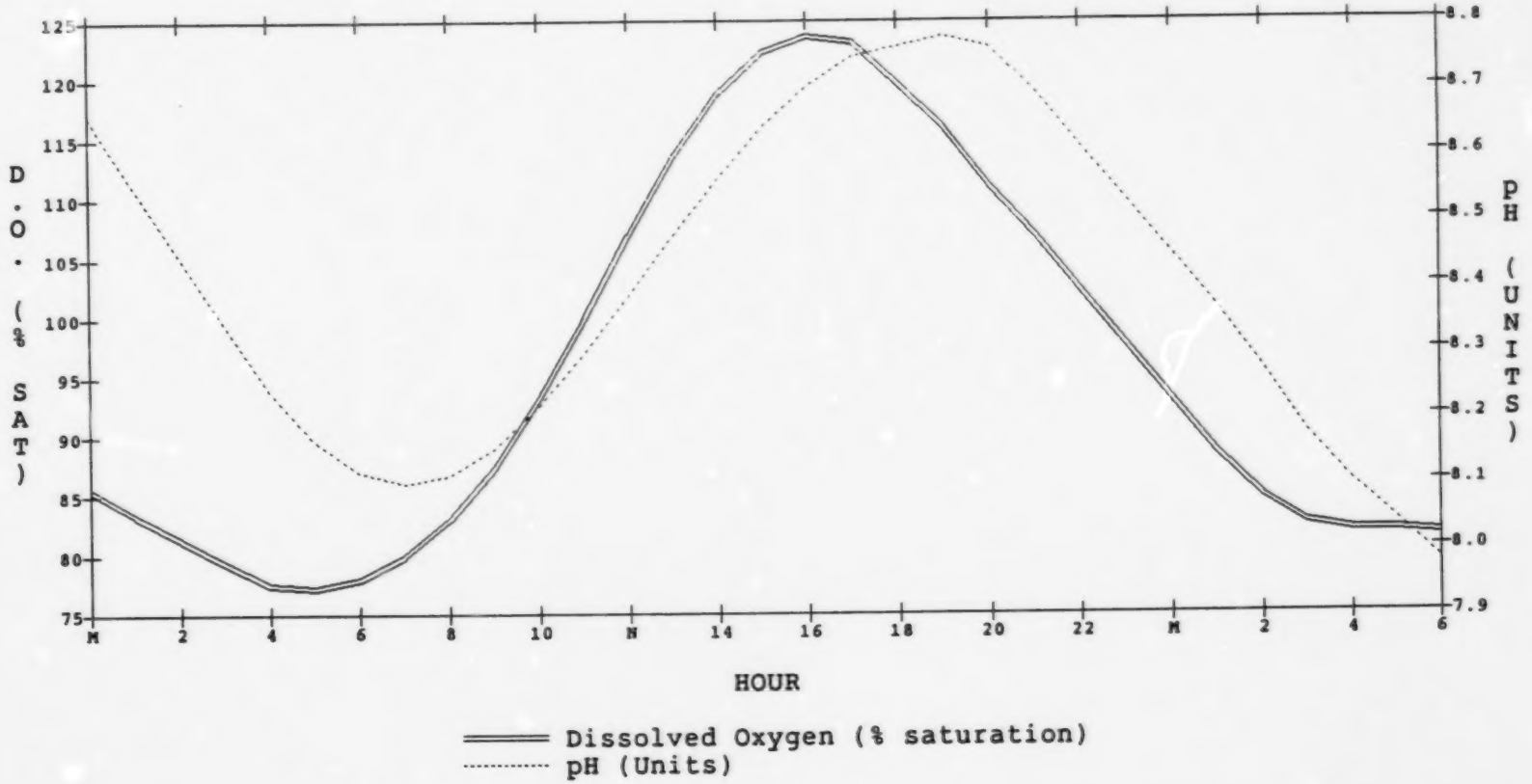
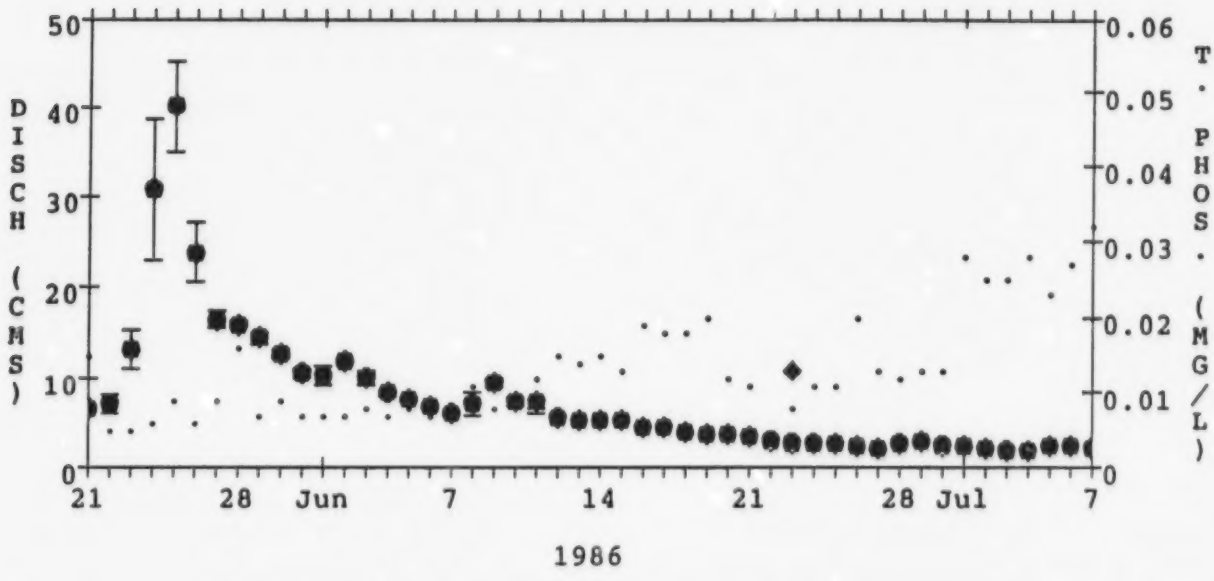
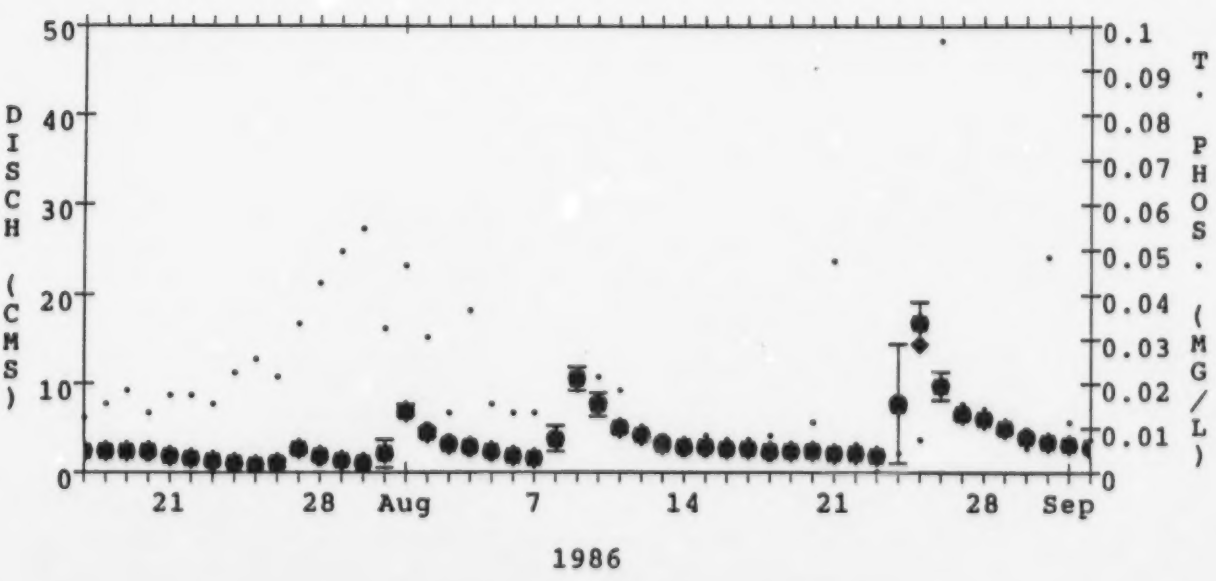


FIG. 18
TOTAL PHOSPHORUS (MG/L) AND DAILY MEAN DISCHARGE (CMS)
BIG PRESQUE ISLE STREAM AT TRACEY MILLS
MAY 21 TO JULY 7, 1986.



● MEAN DAILY DISCH +/- STD. DEVIATION (CMS)
T. PHOSPHORUS (MG/L)
◆ T. PHOSPHORUS (MG/L) - GRAB SAMPLE

FIG. 19
TOTAL PHOSPHORUS (MG/L) AND DAILY MEAN DISCHARGE (CMS)
BIG PRESQUE ISLE STREAM AT TRACEY MILLS
JULY 17 TO SEPTEMBER 2, 1986.



● MEAN DAILY DISCH +/- STD. DEVIATION (CMS)
TOTAL PHOSPHORUS (MG/L)
◆ T. PHOSPHORUS (MG/L)- GRAB SAMPLE

FIG. 20
TOTAL PHOSPHORUS (MG/L) IN DAILY SAMPLES
BIG PRESQUE ISLE STREAM AT TRACEY MILLS
MAY 21 TO JULY 7, 1986.

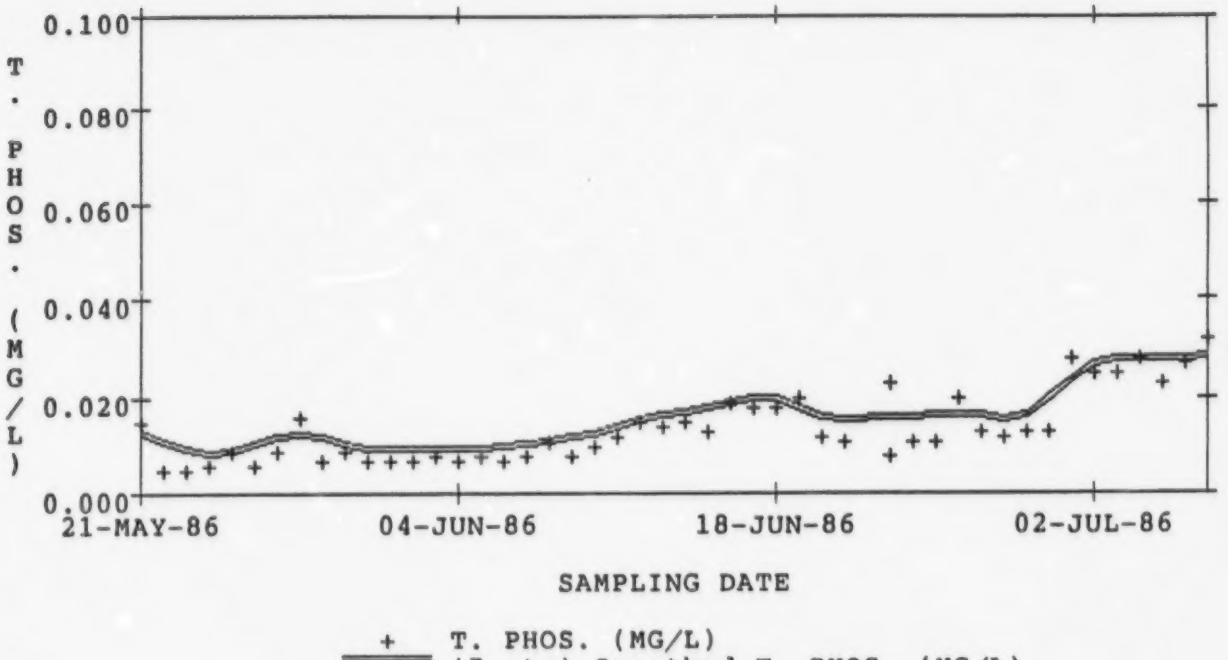


FIG. 21
TOTAL PHOSPHORUS (MG/L) IN DAILY SAMPLES
BIG PRESQUE ISLE STREAM AT TRACEY MILLS
JULY 17 TO SEPTEMBER 3, 1986.

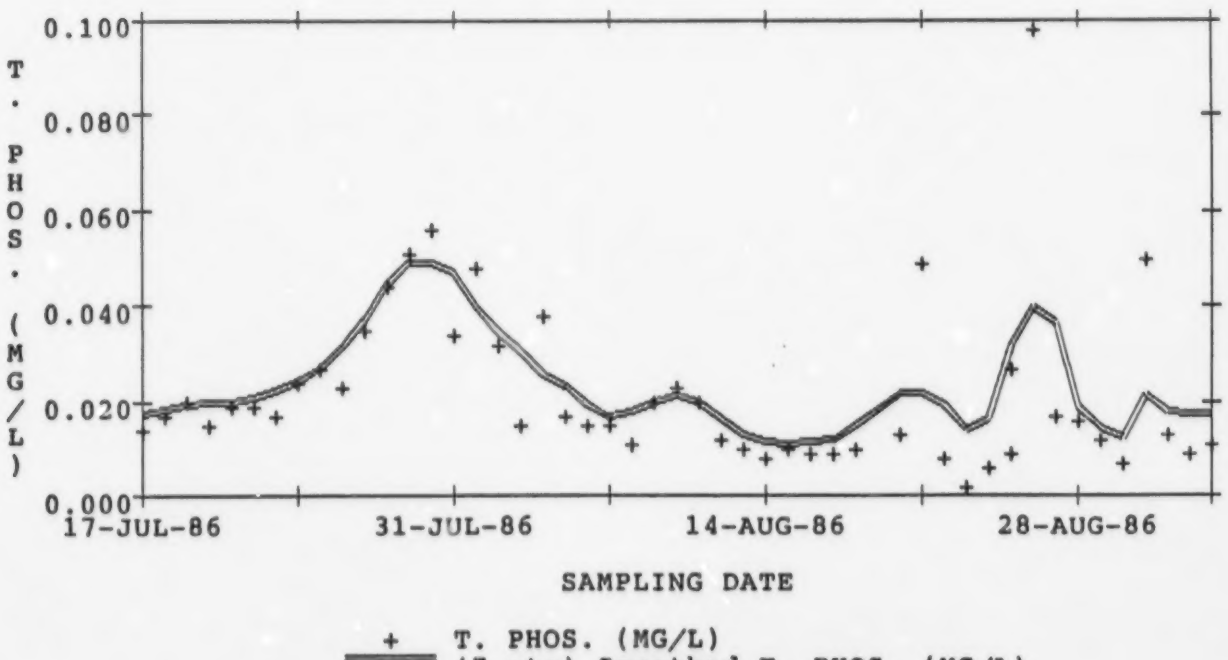


FIG. 22
TOTAL NITROGEN (MG/L) IN DAILY SAMPLES
BIG PRESQUE ISLE STREAM AT TRACEY MILLS
MAY 21 TO JULY 7, 1986.

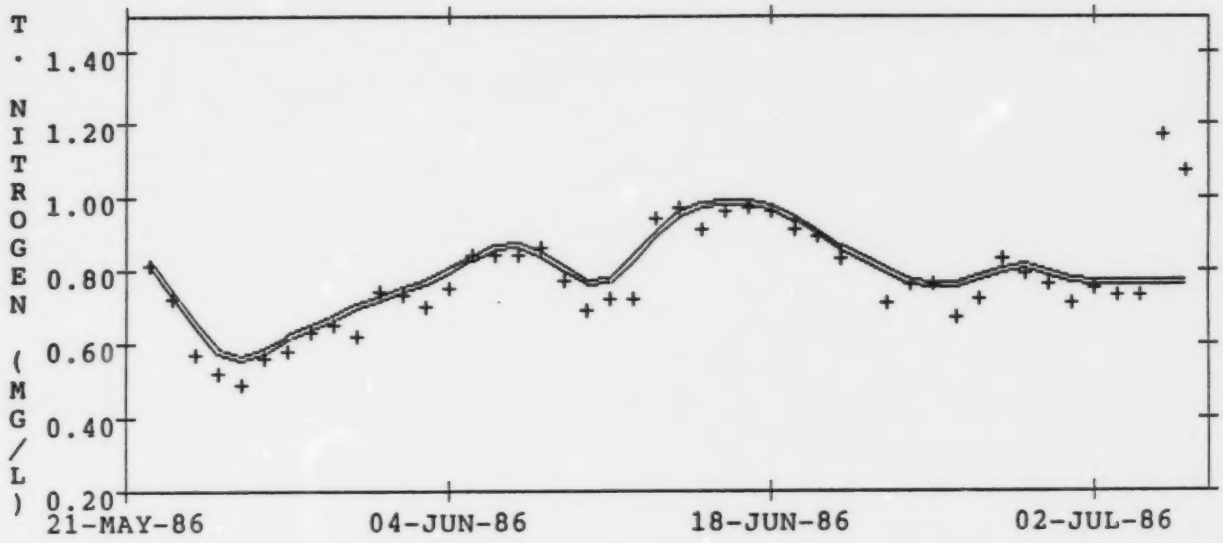


FIG. 23
TOTAL NITROGEN (MG/L) IN DAILY SAMPLES
BIG PRESQUE ISLE STREAM AT TRACEY MILLS
JULY 17 TO SEPTEMBER 3, 1986.

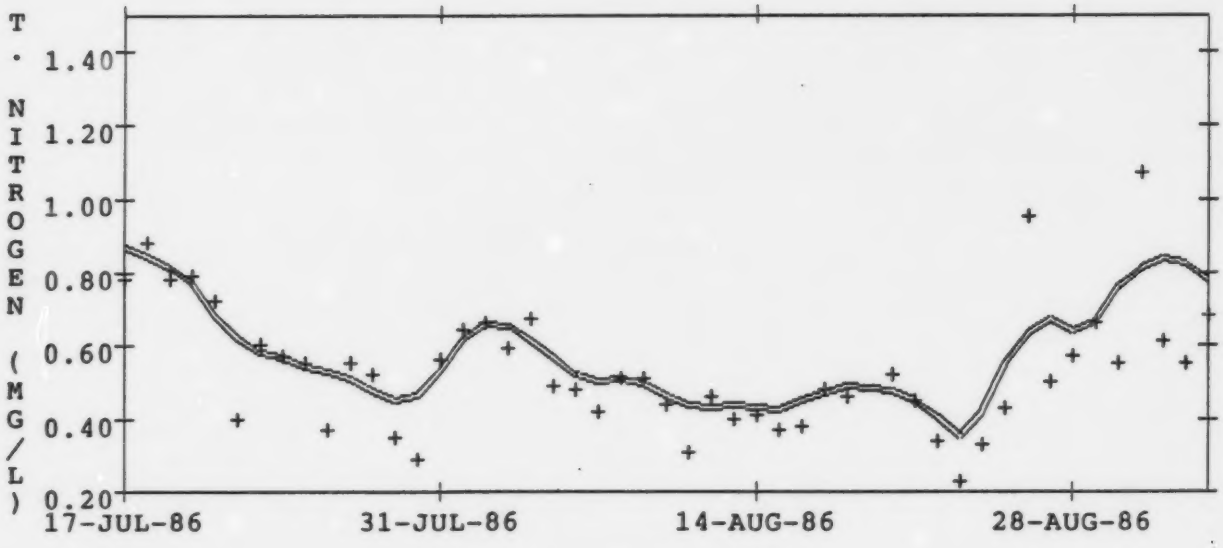


FIG. 24
DISSOLVED ORGANIC CARBON (MG/L) IN DAILY SAMPLES
BIG PRESQUE ISLE STREAM AT TRACEY MILLS
MAY 21 TO JULY 7, 1986.

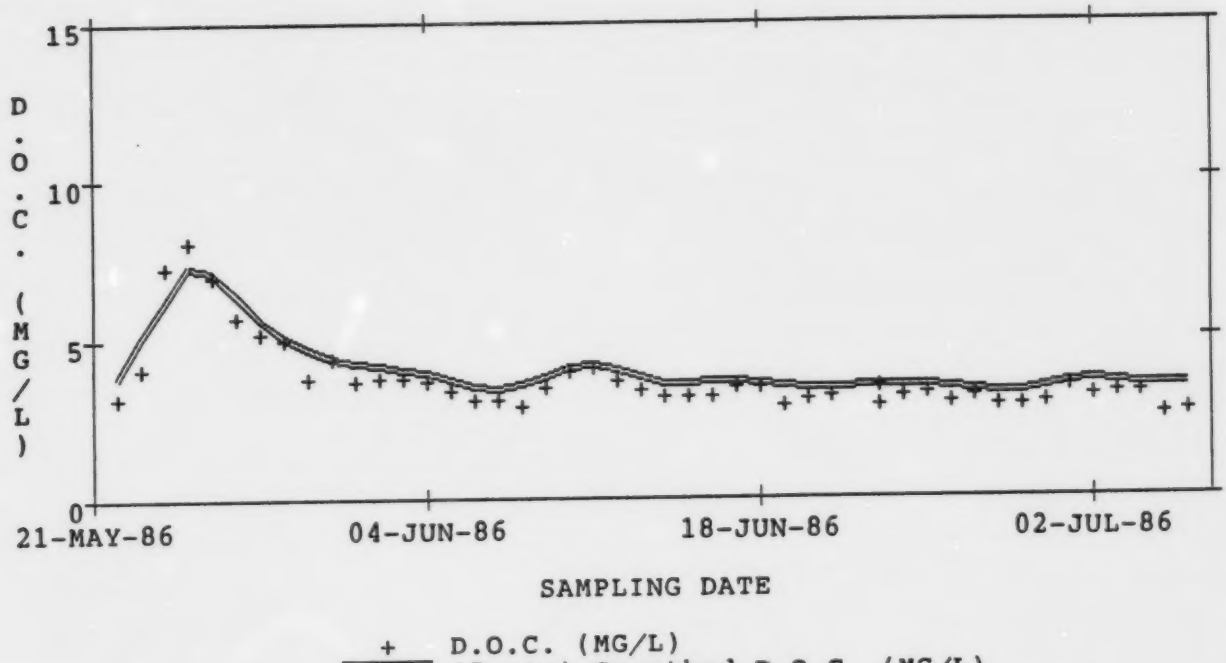


FIG. 25
DISSOLVED ORGANIC CARBON (MG/L) IN DAILY SAMPLES
BIG PRESQUE ISLE STREAM AT TRACEY MILLS
JULY 17 TO SEPTEMBER 3, 1986.

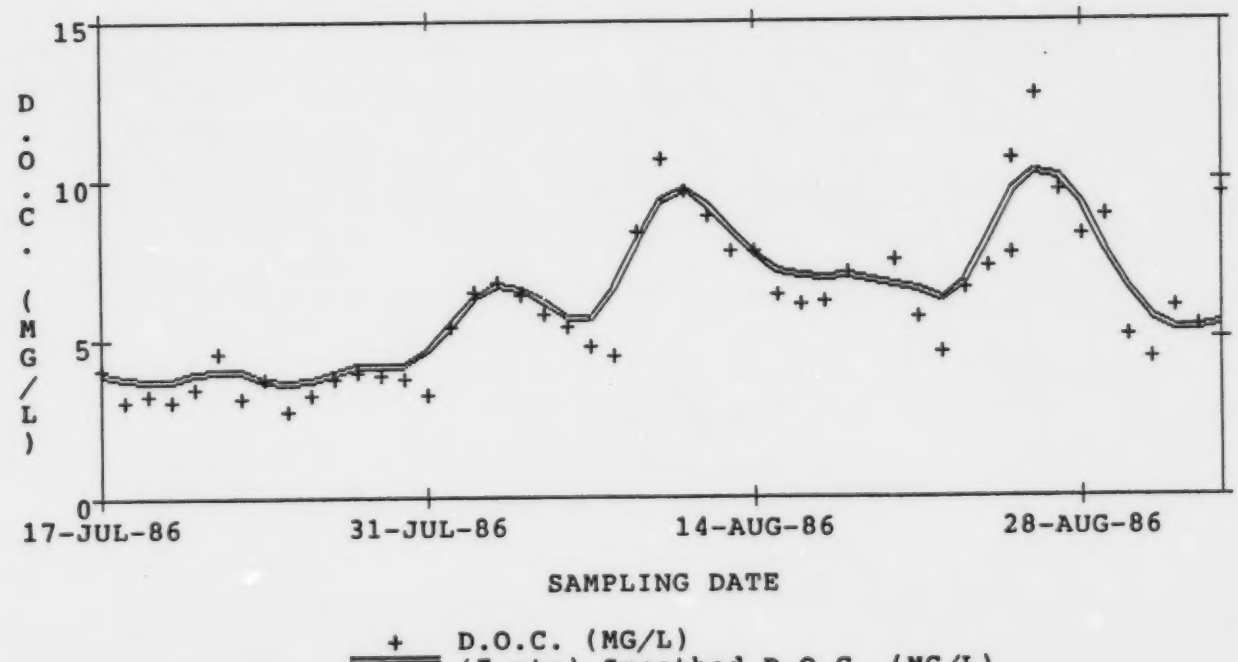


FIG. 26
DISSOLVED vs EXTRACTABLE AL (MG/L)
SAINT JOHN RIVER AT CLAIR
1986.

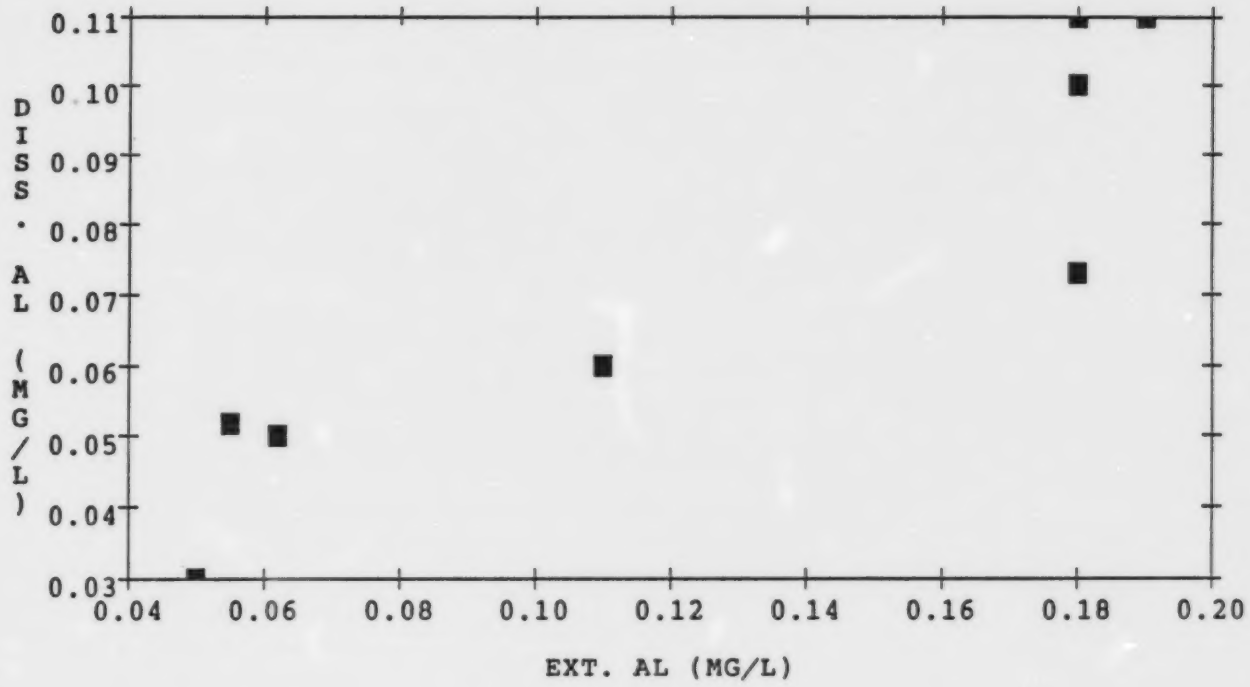


FIG. 27
DISSOLVED vs EXTRACTABLE AL (MG/L)
SAINT JOHN RIVER AT EDMUNDSTON
1986.

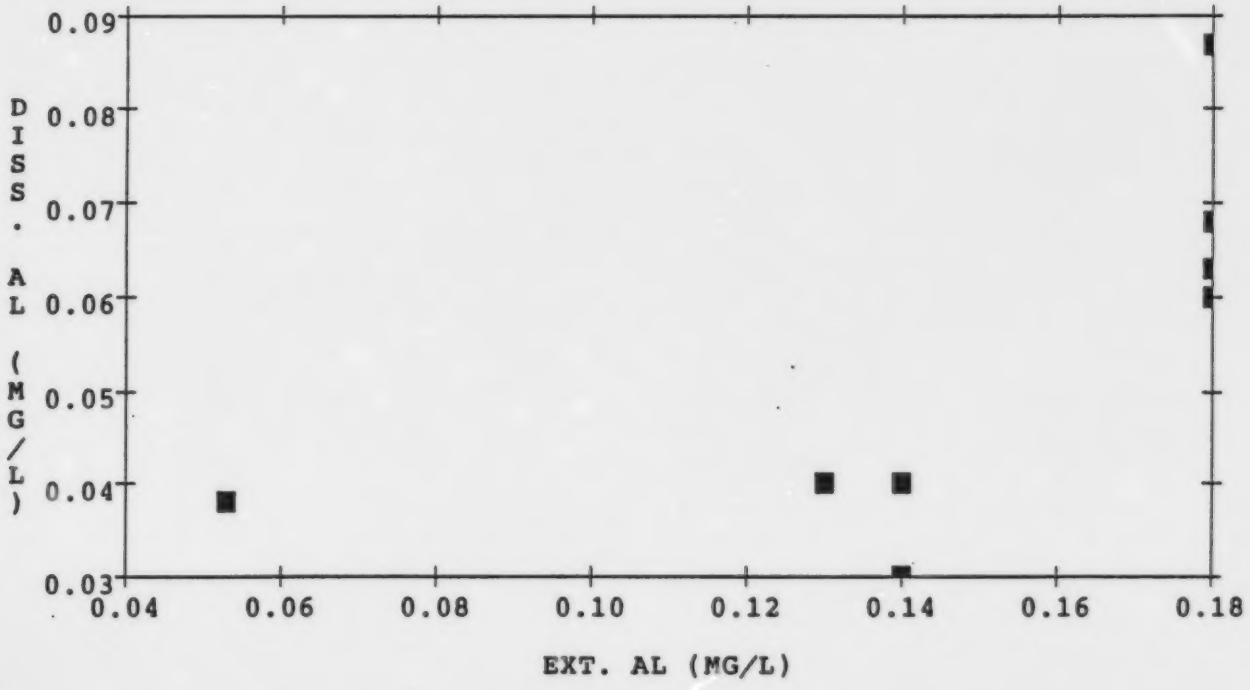


FIG. 28
DISSOLVED vs EXTRACTABLE AL (MG/L)
MADAWASKA RIVER AT EDMUNDSTON
1986.

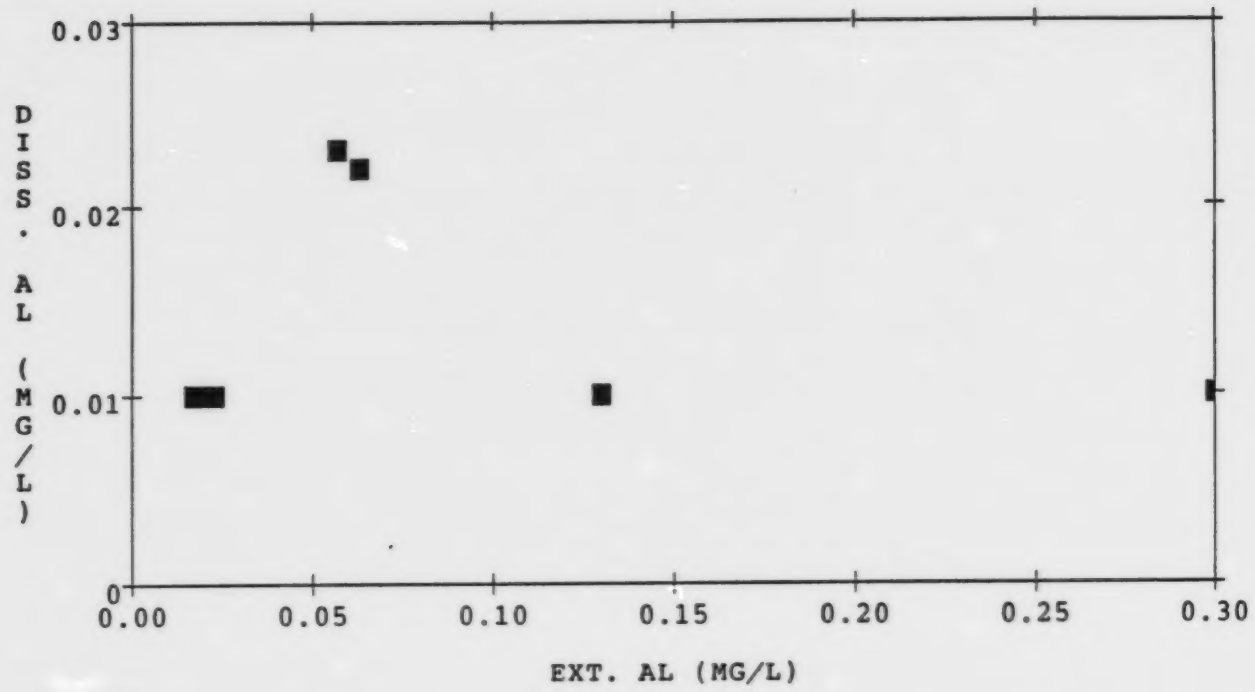


FIG. 29
DISSOLVED vs EXTRACTABLE AL (MG/L)
SAINT JOHN RIVER AT ST BASILE
1986.

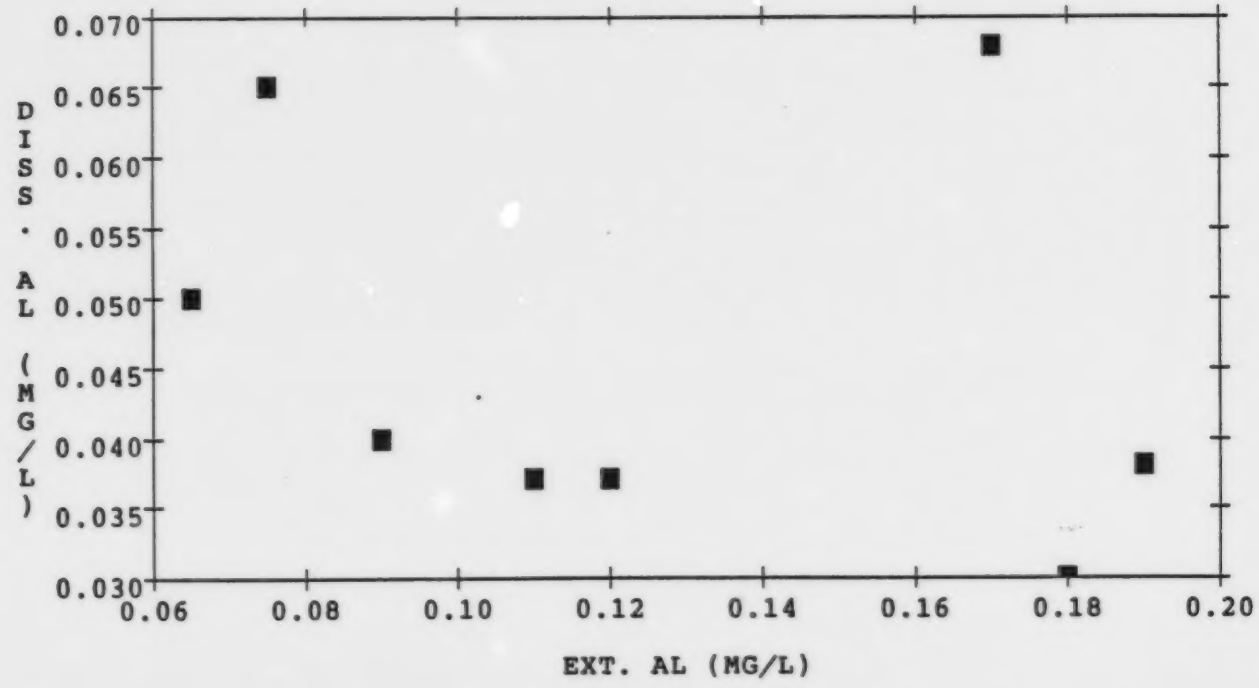


FIG. 30
TOTAL DISSOLVED ALUMINUM (MG/L) vs DISSOLVED ORGANIC CARBON (MG/L)
SAINT JOHN RIVER BASIN
1986.

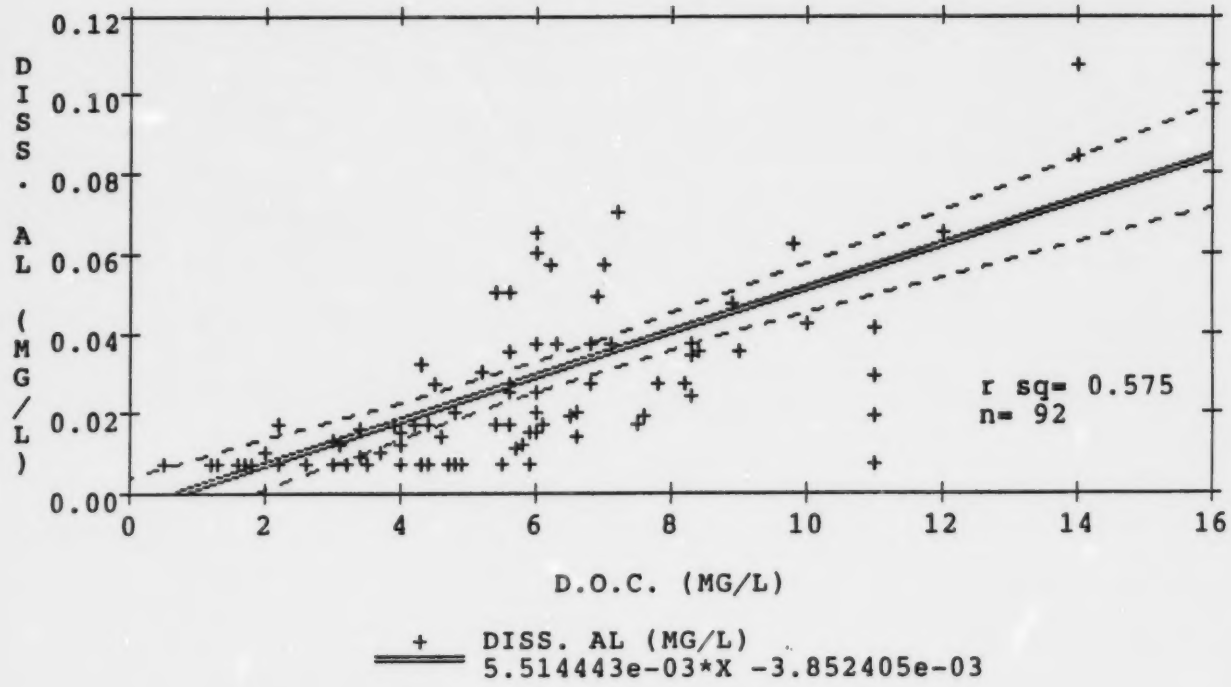


FIG. 31
EXTRACTABLE ALUMINUM (MG/L) vs DISSOLVED ORGANIC CARBON (MG/L)
SAINT JOHN RIVER BASIN
1986.

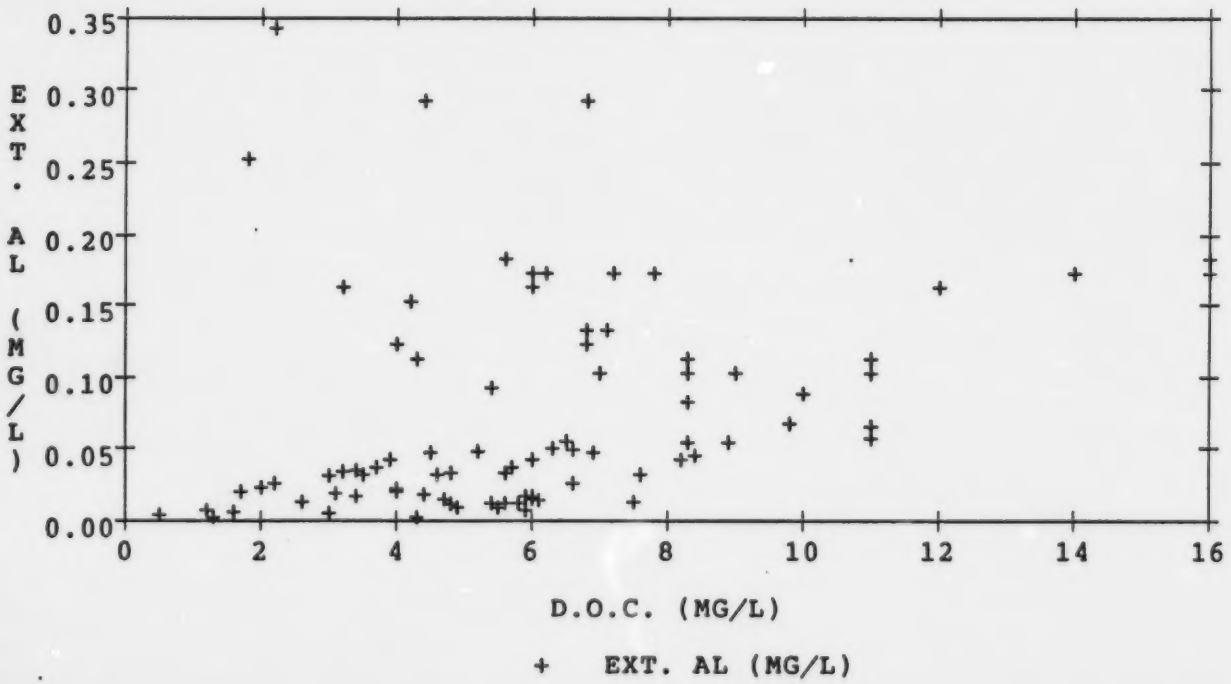


FIG. 32
TOTAL DISSOLVED ALUMINUM (MG/L) vs APPARENT COLOUR (UNITS)
SAINT JOHN RIVER BASIN
1986.

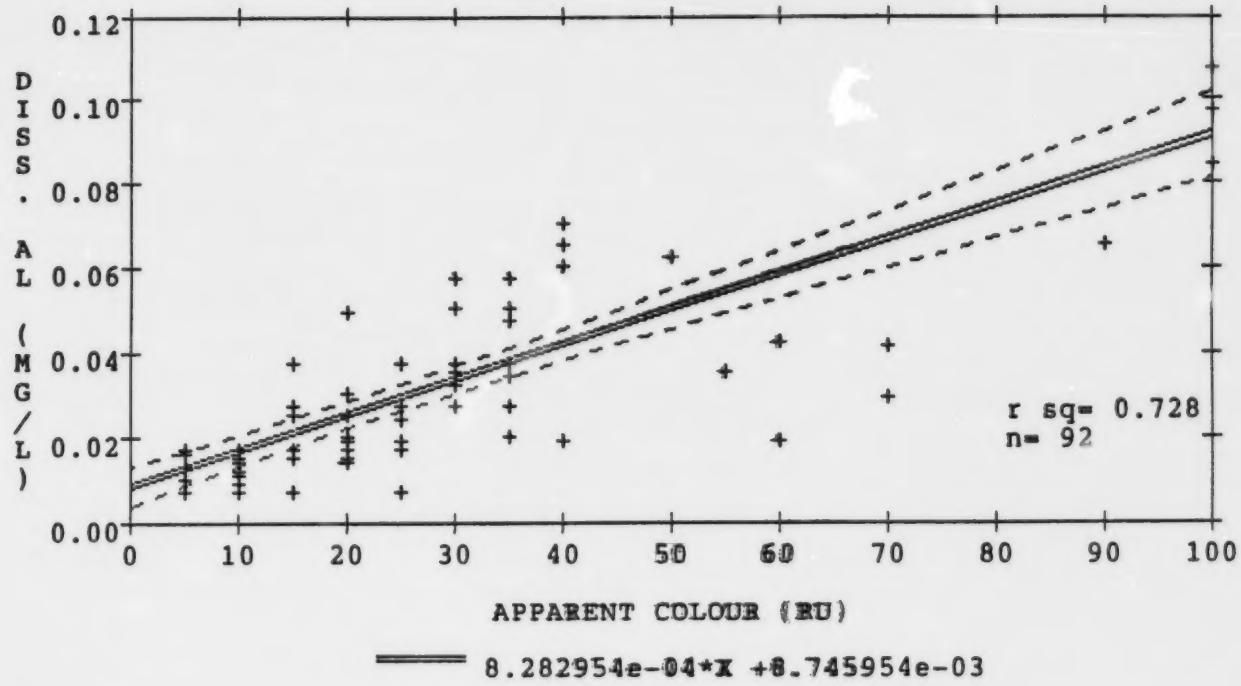


FIG. 33
EXTRACTABLE ALUMINUM (MG/L) vs APPARENT COLOUR (REL UNITS)
SAINT JOHN RIVER BASIN
1986.

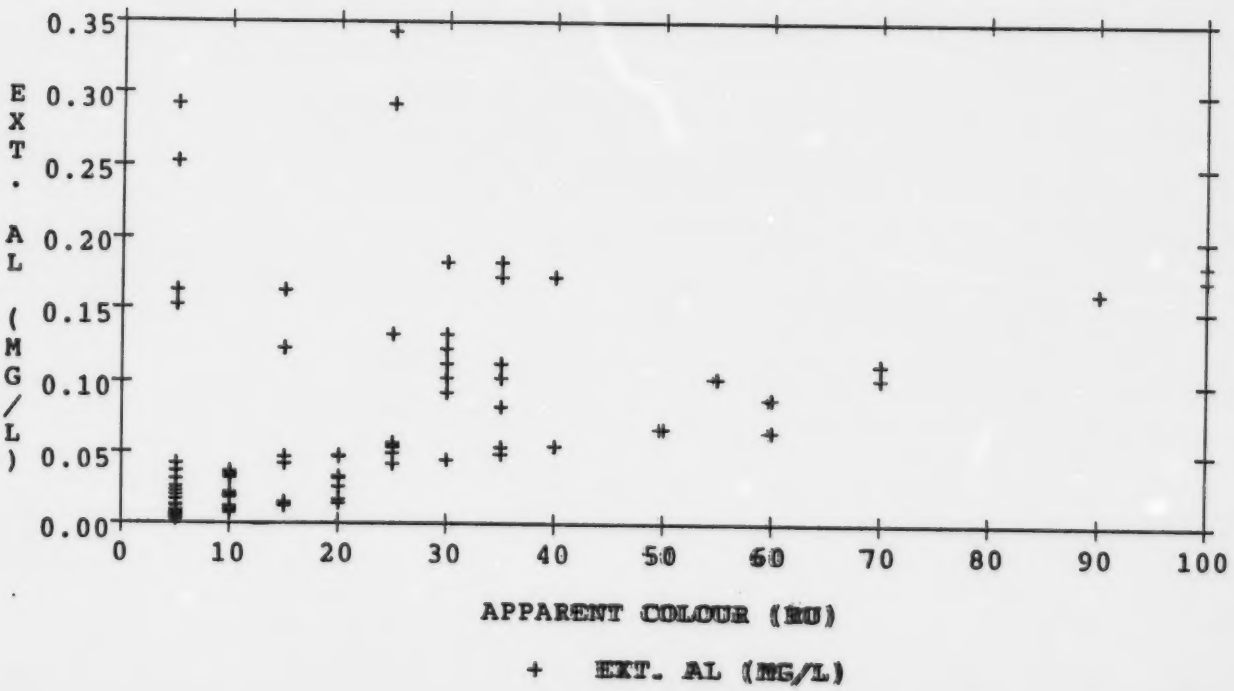


FIG. 34
TOTAL DISSOLVED ALUMINUM (MG/L) vs TURBIDITY (JTU)
SAINT JOHN RIVER BASIN
1986.

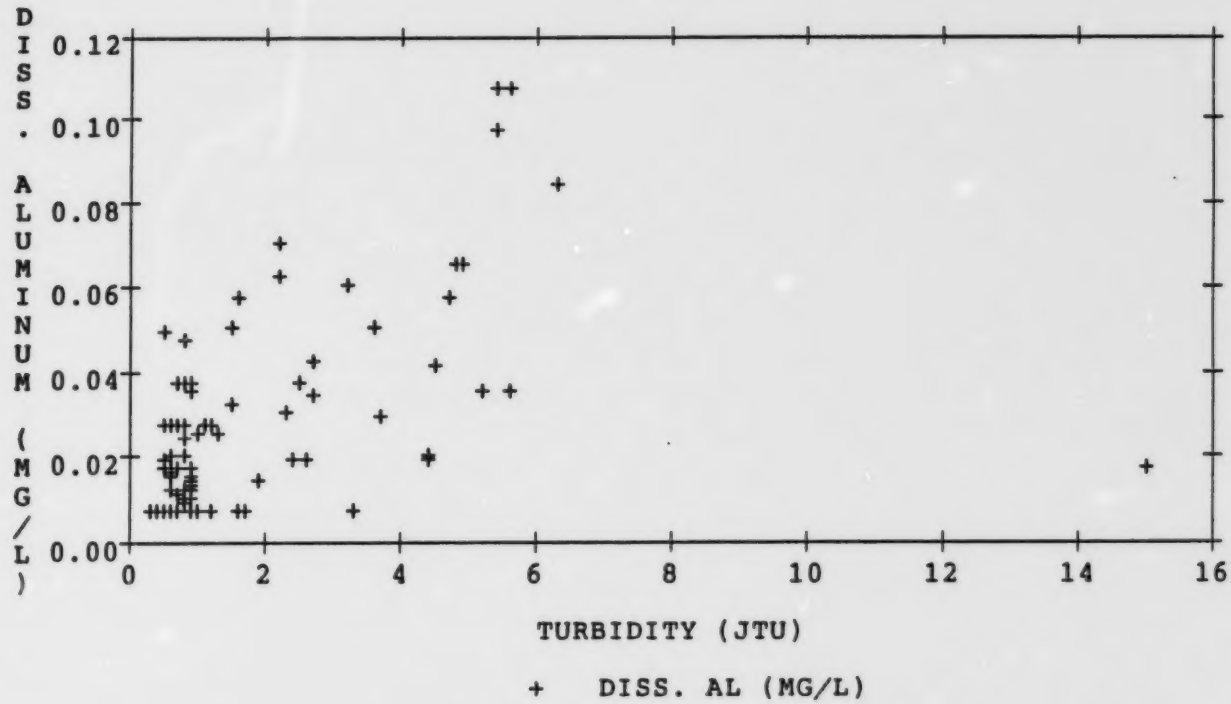


FIG. 35
EXTRACTABLE ALUMINUM (MG/L) vs TURBIDITY (JTU)
SAINT JOHN RIVER BASIN
1986.

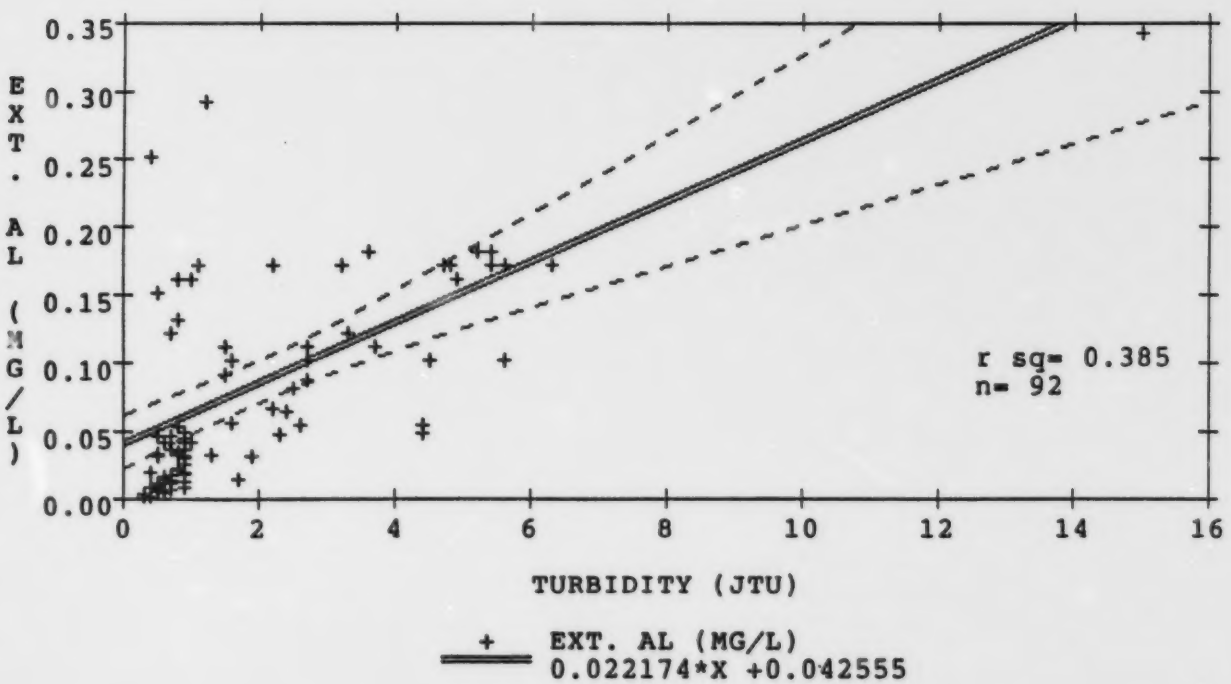


FIG. 36
TOTAL DISSOLVED ALUMINUM (MG/L) vs NONFILTERABLE RESIDUE (MG/L)
SAINT JOHN RIVER BASIN
1986.

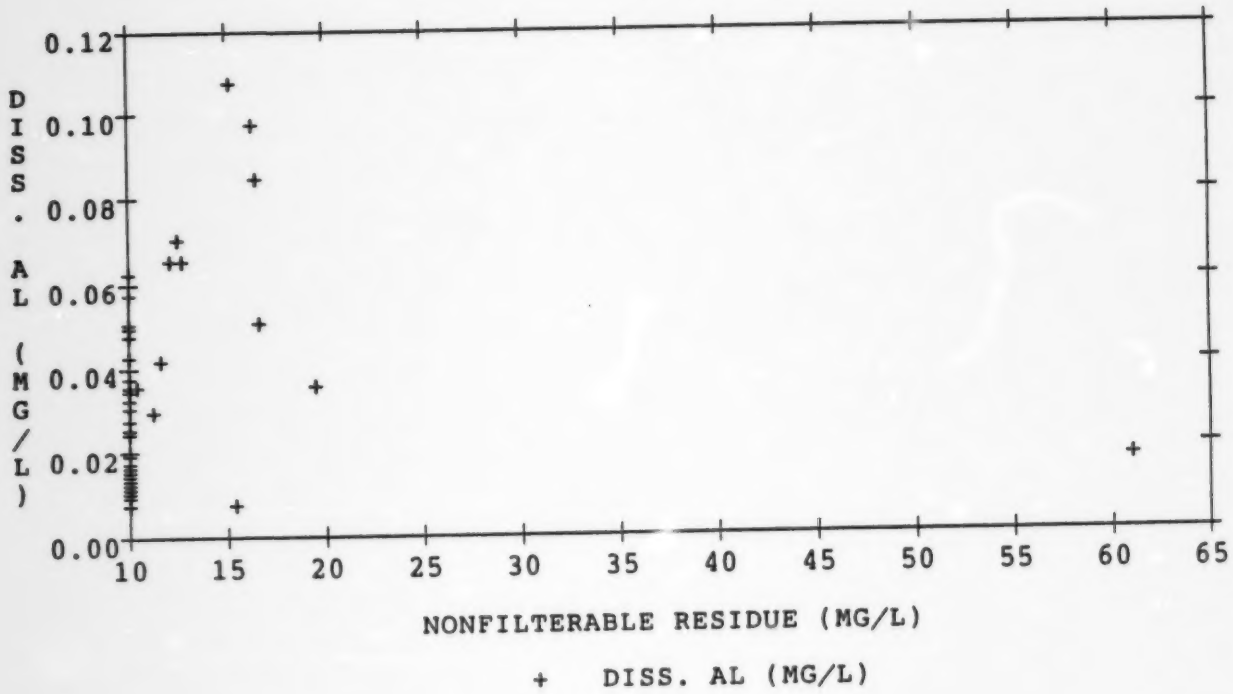
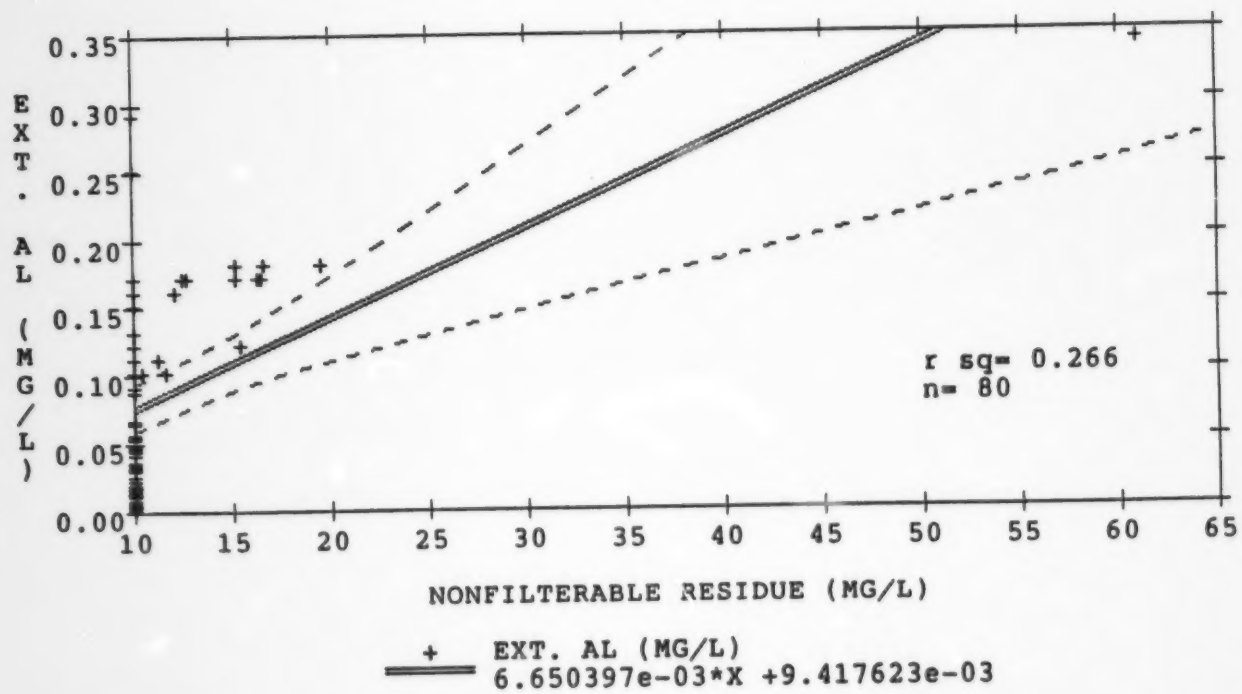


FIG. 37
EXTRACTABLE ALUMINUM (MG/L) vs NONFILTERABLE RESIDUE (MG/L)
SAINT JOHN RIVER BASIN
1986.



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2 International Saint John River Basin. Sampling Station Locations in 1986

3 Analytical Results of Field Blanks for Trace Metals Prepared During 1986 Monitoring of International Saint John River

4 Analytical Results of Field Blanks for Total and Dissolved Phosphorus Prepared During 1986 Monitoring of International Saint John River

5 Water Temperature, Dissolved Oxygen and pH Measurements Mode in the International Saint John River Basin During 1986

6 Trace Metals in International Waters of Saint John River Basin Sampled During 1986

Table 7 Nutrients and Nonfilterable Residue in Waters of the International Saint John River Basin Sampled During 1986

8 Big Presque Isle Stream at Tracey Mills - AWQM Data Summary - July 1 to August 31, 1986

TABLE 1

NAQUADAT Parameter Code	Parameter Measured	W.Q. Objective "Safe"	"Acute"
02065F & S	Water Temperature (°C)	20.0	25.0
08102F & S	Dissolved Oxygen (mg/L)		>5.0
08002S	Dissolved Oxygen (% Sat)		>80% <110%
10301L	pH (units)	6.0-9.0	<4.0 >9.8
13305P	Extractable Aluminum(mg/L)	0.100	>1.0 <5.0
13102L 13106L	Dissolved Aluminum (mg/L)	0.100	>1.0 <5.0
15413P	Total Phosphorus (mg/L)	0.100* 0.025**	0.015***
15104L	Total Dissolved Phosphorus (mg/L)	0.100* 0.025**	0.015***
10401L	Non-Filterable Residue(mg/L)	25.0	100
29305P	Extractable Copper (mg/L)	0.005	0.020
30304P	Extractable Zinc (mg/L)	0.030	0.080
82302P	Extractable Lead (mg/L)	0.005	0.030
80315P	Extractable Mercury (ug/L)	0.064	3.0

* Nuisance level for water in a flowing stream
** Nuisance level for water in an impoundment
*** Indicative of a potential algal bloom

TABLE 2

Sampling Stations in International Saint John River Basin

Sampled During 1986

Station No.	NAQUADAT Sta. No.	Location
1	00NB01AD0001	Saint John River at Clair
2	00NB01AD0008	Saint John River at Edmundston -Madawaska
3	00NB01AD0013	St. Francis River at Picnic Site
4	00NB01AD0016	Madawaska River at Power Plant Tailrace
5	00NB01AF0021	Green River at W.S.C. Gauge
6	00NB01AF0038	Saint John River at St. Basile
7	00NB01AG0003	Limestone River at Four Falls at W.S.C. Gauge
8	00NB01AJ0006	Big Presque Isle Stream at Tracey Mills
9	00NB01AJ0029	Meduxnekeag River at Belleville
10	01NB01AF0005	Saint John River at Grand Falls Dam
11	01NB01AG0001	Aroostook River at Tinker Dam

TABLE 3
ANALYTICAL RESULTS OF FIELD BLANKS FOR TRACE METALS
PREPARED DURING 1986 MONITORING OF INTERNATIONAL SAINT JOHN RIVER
(PROJECT SUB ID 0205)

STN	SAMPLE	SDATE	SUBID	EXT Al mg/l	DISS. Al mg/l	EXT Cu mg/l	EXT Pb mg/l	EXT Zn mg/l	EXT Hg mg/l
01NB01AF9905	503397	25-FEB-86	205	L.01	L.01	L.002	L.002	L.01	L.02
01NB01AF9905	503398	26-FEB-86	205	L.01	L.01	L.002	L.002	L.01	L.02
01NB01AF9905	600016	25-MAR-86	205	L.010	L.010	0.002	L.002	L.01	L.02
01NB01AF9905	600017	26-MAR-86	205	L.010	L.010	L.002	L.002	L.01	L.02
01NB01AF9905	600283	21-APR-86	205	L.01	L.01	L.002	L.002	L.01	L.02
01NB01AF9905	600284	22-APR-86	205	L.01	L.01	L.002	L.002	L.01	L.02
01NB01AF9905	601151	24-JUN-86	205	L.01		L.002	L.002	L.01	L.02
01NB01AF9905	601709	25-AUG-86	205	L.01		L.002	L.002	L.01	L.02
01NB01AF9905	601710	27-AUG-86	205	L.01	L.01	L.002	L.002	L.01	

TABLE 4
ANALYTICAL RESULTS OF FIELD BLANKS FOR TOTAL AND DISSOLVED PHOSPHORUS PREPARED DURING 1986 MONITORING OF INTERNATIONAL SAINT JOHN RIVER (PROJECT SUB ID 0205)

STN	SAMPLE	SDATE	SUBID	T. PHOS. mg/l	DISS. PHOS. mg/l	
01NB01AF9905	503397	25-FEB-86	205	L.001	L.001	
00NB01AF9905	503398	26-FEB-86	205	L.001	L.001	
01NB01AF9905	600016	25-MAR-86	205	L.001	L.001	
01NB01AF9905	600017	26-MAR-86	205	L.001	L.001	
01NB01AF9905	600283	21-APR-86	205	L.001	L.001	
01NB01AF9905	600284	22-APR-86	205	L.001	L.001	
01NB01AF9905	601151	24-JUN-86	205	L.001	L.001	
01NB01AF9905	601709	25-AUG-86	205	L.001		
01NB01AF9905	601710	27-AUG-86	205	L.001		0.001
00NB01AJ9929	602434	27-OCT-86	205	L.001	L.001	
00NB01AJ9929	602435	27-OCT-86	205	L.001		0.001

TABLE 5
WATER TEMPERATURE, DISSOLVED OXYGEN AND pH MEASUREMENTS
MADE IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
DURING 1986
(PROJECT SUB ID 0205)

STATION NO.	SAMPLING DATE	SAMPLING TIME	WATER TEMP (C)	DISS. OXYGEN (mg/l)	DISS. OXYGEN (% sat)	pH (UNITS)
00NB01AD0001	26-FEB-86	1345	0.3	14.9	106.1	7.1
00NB01AD0001	22-APR-86	1230	4.0	12.4	97.7	6.9
00NB01AD0001	24-JUN-86	1610	20.5	8.2	96.2	7.4
00NB01AD0001	26-AUG-86	1435	14.5	9.2	94.4	7.0
00NB01AD0001	26-AUG-86	1431				7.0
00NB01AD0001	26-AUG-86	1430				7.0
00NB01AD0008	22-APR-86	950	4.0	12.0	94.5	7.0
00NB01AD0008	22-APR-86	952				7.0
00NB01AD0008	22-APR-86	954				6.9
00NB01AD0008	24-JUN-86	1330	21.5	9.5	113.9	7.3
00NB01AD0008	24-JUN-86	1332				7.3
00NB01AD0008	24-JUN-86	1334				7.3
00NB01AD0008	26-AUG-86	1030	14.1	9.7	98.6	7.1
00NB01AD0013	26-FEB-86	1300	0.9	14.9	107.9	7.4
00NB01AD0013	26-MAR-86	1100	1.4	13.4	98.4	7.4
00NB01AD0013	26-MAR-86	1105				7.3
00NB01AD0013	26-MAR-86	1110				7.4
00NB01AD0013	22-APR-86	1145	3.0	11.8	90.5	7.2
00NB01AD0013	24-JUN-86	1507				7.4
00NB01AD0013	24-JUN-86	1509				7.3
00NB01AD0013	24-JUN-86	1505	16.0	9.3	98.8	7.3
00NB01AD0013	26-AUG-86	1300	17.8	8.8	97.3	7.5
00NB01AD0016	26-FEB-86	1030	0.6	15.5	111.3	7.8
00NB01AD0016	26-FEB-86	1035				7.8
00NB01AD0016	26-FEB-86	1040				7.8
00NB01AD0016	26-MAR-86	950	0.2	15.1	107.2	7.7
00NB01AD0016	22-APR-86	930	2.6	12.3	93.3	7.5
00NB01AD0016	24-JUN-86	1225	17.8	9.0	99.6	7.7
00NB01AD0016	26-AUG-86	1000	15.0	8.6	89.3	7.5
00NB01AD0016	26-AUG-86	1010		8.6		7.3
00NB01AD0016	26-AUG-86	1005		8.6		7.5
00NB01AF0021	26-FEB-86	915	0.4	12.8	91.4	7.6
00NB01AF0021	26-MAR-86	900	0.2	13.3	94.4	7.4
00NB01AF0021	22-APR-86	830	2.8	13.2	100.7	7.2
00NB01AF0021	24-JUN-86	1130	18.0	9.5	105.6	7.7
00NB01AF0021	26-AUG-86	845	11.4	10.4	99.1	7.5
00NB01AF0038	26-FEB-86	955	0.5	15.9	113.9	7.1
00NB01AF0038	26-MAR-86	930	0.8	12.8	92.4	7.2
00NB01AF0038	22-APR-86	915	4.0	12.2	96.1	7.2
00NB01AF0038	24-JUN-86	1201	20.4	8.6	100.7	7.2
00NB01AF0038	25-AUG-86	915	14.2	9.3	94.7	7.1
00NB01AG0003	25-FEB-86	1530	0.3	15.7	111.8	8.1
00NB01AG0003	25-MAR-86	1510	0.0	14.0	98.9	8.1
00NB01AG0003	21-APR-86	1510	5.0			7.8

TABLE 5

WATER TEMPERATURE, DISSOLVED OXYGEN AND pH MEASUREMENTS
MADE IN THE INTERNATIONAL SAINT JOHN RIVER BASIN
DURING 1986
(PROJECT SUB ID 0205)

STATION NO.	SAMPLING DATE	SAMPLING TIME	WATER TEMP (C)	DISS. OXYGEN (mg/l)	DISS. OXYGEN (% sat)	pH (UNITS)
00NB01AG0003	25-JUN-86	1430	15.5	10.8	113.4	8.3
00NB01AG0003	25-AUG-86	1615	14.8	9.1	94.0	7.8
00NB01AJ0006	21-APR-86	1345	4.7	14.2	114.0	7.9
00NB01AJ0006	21-APR-86	1347				7.9
00NB01AJ0006	21-APR-86	1349				7.8
00NB01AJ0006	23-JUN-86	1522	21.0	11.2	132.8	8.3
00NB01AJ0006	25-AUG-86	1510	14.0	10.3	104.4	7.8
00NB01AJ0029	25-FEB-86	1215	0.5	13.3	95.2	7.9
00NB01AJ0029	25-MAR-86	1215	0.4	13.8	98.5	7.5
00NB01AJ0029	25-MAR-86	1220				7.7
00NB01AJ0029	25-MAR-86	1225				7.6
00NB01AJ0029	21-APR-86	1215	5.0	12.5	101.1	7.5
00NB01AJ0029	23-JUN-86	1400	21.0	8.6	102.0	8.2
00NB01AJ0029	25-AUG-86	1330	14.5	8.5	87.2	7.5
01NB01AF0005	25-MAR-86	1550		10.5		7.2
01NB01AF0005	21-APR-86	1600	4.5	14.3	114.2	7.1
01NB01AF0005	24-JUN-86	830	19.3	8.6	98.3	7.3
01NB01AF0005	25-AUG-86	1645	16.8	8.5	91.9	7.3
01NB01AG0001	25-FEB-86	1500	0.3	13.3	94.7	7.2
01NB01AG0001	25-MAR-86	1445	0.0	11.2	79.1	7.6
01NB01AG0001	21-APR-86	1445	5.3	13.8	112.5	7.2
01NB01AG0001	23-JUN-86	1650	21.0	8.8	104.4	7.7
01NB01AG0001	25-AUG-86	1545	15.2	8.0	83.4	7.4

TABLE 6
TRACE METALS IN INTERNATIONAL WATERS OF SAINT JOHN RIVER BASIN
SAMPLED DURING 1986
(PROJECT SUB ID 0205)

STN	SAMPLE	SDATE	STIME	SUBID	EXT. Al (mg/l)	DISS. Al. (mg/l)	EXT. Cu (mg/l)	EXT. Pb (mg/l)	EXT. Zn (mg/l)	EXT. Hg (ug/l)
00NB01AD0001	503392	26-FEB-86	1345	205	0.055	0.052	L.002	L.002	L.01	L.02
00NB01AD0001	600281	22-APR-86	1230	205	0.180	0.073	L.002	0.002	L.01	L.02
00NB01AD0001	601148	24-JUN-86	1610	205	0.050	0.030	L.002	L.002	L.01	L.02
00NB01AD0001	601700	26-AUG-86	1435	T205	0.180	0.110	L.002	L.002	L.01	L.02
00NB01AD0001	601701	26-AUG-86	1431	T205	0.190	0.110	L.002	L.002	L.01	L.02
00NB01AD0001	601699	26-AUG-86	1430	T205	0.180	0.100	L.002	L.002	L.01	L.02
00NB01AD0008	600278	22-APR-86	950	T205	0.180	0.068	L.002	L.002	L.01	L.02
00NB01AD0008	600279	22-APR-86	952	T205	0.180	0.063	L.002	L.002	L.01	L.02
00NB01AD0008	600280	22-APR-86	954	T205	0.180	0.060	L.002	0.002	L.01	L.02
00NB01AD0008	601142	24-JUN-86	1330	T205	0.140	0.040	0.003	L.002	L.01	L.02
00NB01AD0008	601143	24-JUN-86	1332	T205	0.140	0.030	0.003	L.002	L.01	L.02
00NB01AD0008	601144	24-JUN-86	1334	T205	0.130	0.040	0.003	L.002	L.01	L.02
00NB01AD0008	601697	26-AUG-86	1030	205	0.180	0.087	L.002	L.002	L.01	L.02
00NB01AD0013	503393	26-FEB-86	1300	205	0.022	0.020	L.002	L.002	L.01	L.02
00NB01AD0013	600013	26-MAR-86	1100	T205	0.023	0.018	L.002	L.002	L.01	L.02
00NB01AD0013	600014	26-MAR-86	1105	T205	0.025	0.018	L.002	L.002	L.01	L.02
00NB01AD0013	600015	26-MAR-86	1110	T205	0.025	0.023	L.002	L.002	L.01	L.02
00NB01AD0013	600282	22-APR-86	1145	205	0.056	0.033	L.002	L.002	L.01	L.02
00NB01AD0013	601146	24-JUN-86	1507	T205	0.020	0.020	L.002	L.002	L.01	L.02
00NB01AD0013	601147	24-JUN-86	1509	T205	0.020	0.020	0.002	L.002	L.01	L.02
00NB01AD0013	601145	24-JUN-86	1505	T205	0.020	0.030	L.002	L.002	L.01	L.02
00NB01AD0013	601698	26-AUG-86	1300	205	0.034	0.017	L.002	L.002	L.01	L.02
00NB01AD0016	503394	26-FEB-86	1030	T205	0.017	L.010	L.002	L.002	L.01	L.02
00NB01AD0016	503395	26-FEB-86	1035	T205	0.017	L.010	L.002	L.002	L.01	L.02
00NB01AD0016	503396	26-FEB-86	1040	T205	0.019	L.010	L.002	L.002	L.01	L.02
00NB01AD0016	600012	26-MAR-86	950	205	0.023	L.010	L.002	L.002	L.01	L.02
00NB01AD0016	600277	22-APR-86	930	205	0.130	0.010	L.002	L.002	L.01	L.02
00NB01AD0016	601141	24-JUN-86	1225	205	0.300	0.010	L.002	L.002	L.01	L.02
00NB01AD0016	601696	26-AUG-86	1000	T205	0.063	0.022	L.002	L.002	L.01	L.02
00NB01AD0016	601708	26-AUG-86	1010	T205	0.063	0.022	L.002	L.002	L.01	L.02
00NB01AD0016	601707	26-AUG-86	1005	T205	0.057	0.023	L.002	L.002	L.01	L.02
00NB01AF0021	503390	26-FEB-86	915	205	0.010	L.010	0.003	L.002	L.01	L.02
00NB01AF0021	600010	26-MAR-86	900	205	0.012	L.010	L.002	L.002	L.01	L.02
00NB01AF0021	600275	22-APR-86	830	205	0.350	0.020	L.002	0.002	L.01	L.02
00NB01AF0021	601139	24-JUN-86	1130	205	0.260	L.01	L.002	L.002	L.01	L.02
00NB01AF0021	601695	26-AUG-86	845	205	0.027	0.015	L.002	L.002	L.01	L.02
00NB01AF0038	503391	26-FEB-86	955	205	0.065	0.050	L.002	L.002	L.01	L.02
00NB01AF0038	600011	26-MAR-86	930	205	0.075	0.065	L.002	L.002	L.01	L.02
00NB01AF0038	600276	22-APR-86	915	205	0.190	0.038	0.002	0.002	L.01	L.02
00NB01AF0038	601140	24-JUN-86	1201	205	0.180	0.030	L.002	L.002	L.01	L.02
00NB01AF0038	601689	25-AUG-86	915	205	0.170	0.068	L.002	L.002	L.01	L.02
00NB01AG0003	503389	25-FEB-86	1530	205	0.039	0.016	L.002	L.002	L.01	L.02
00NB01AG0003	600008	25-MAR-86	1510	205	0.031	0.013	L.002	L.002	L.01	L.02
00NB01AG0003	600273	21-APR-86	1510	205	0.120	0.035	L.002	L.002	L.01	L.02
00NB01AG0003	601149	25-JUN-86	1430	205	0.050	0.020	L.002	L.002	L.01	L.02

TABLE 6
TRACE METALS IN INTERNATIONAL WATERS OF SAINT JOHN RIVER BASIN
SAMPLED DURING 1986
(PROJECT SUB ID 0205)

STN	SAMPLE	SDATE	STIME	SUBID	EXT. Al (mg/l)	DISS. Al. (mg/l)	EXT. Cu (mg/l)	EXT. Pb (mg/l)	EXT. Zn (mg/l)	EXT. Hg (ug/l)
00NB01AG0003	601693	25-AUG-86	1615	205	0.120	0.032	L.002	L.002	L.01	L.02
00NB01AJ0006	600269	21-APR-86	1345	T205	0.045	0.013	L.002	L.002	L.01	L.02
00NB01AJ0006	600270	21-APR-86	1347	T205	0.040	0.010	L.002	L.002	L.01	L.02
00NB01AJ0006	600271	21-APR-86	1349	T205	0.042	0.010	L.002	L.002	L.01	L.02
00NB01AJ0006	601136	23-JUN-86	1522	205	0.170	0.010	L.002	L.002	L.01	L.02
00NB01AJ0006	601691	25-AUG-86	1510	205	0.073	0.022	L.002	L.002	L.01	L.02
00NB01AJ0029	503386	25-FEB-86	1215	205	0.025	0.019	L.002	L.002	L.01	L.02
00NB01AJ0029	600003	25-MAR-86	1215	T205	0.026	0.020	L.002	L.002	L.01	L.02
00NB01AJ0029	600004	25-MAR-86	1220	T205	0.030	0.015	L.002	L.002	L.01	L.02
00NB01AJ0029	600005	25-MAR-86	1225	T205	0.028	0.018	L.002	L.002	L.01	L.02
00NB01AJ0029	600268	21-APR-86	1215	205	0.055	0.030	L.002	L.002	L.01	L.02
00NB01AJ0029	601135	23-JUN-86	1400	205	0.160	0.020	L.002	L.002	L.01	L.02
00NB01AJ0029	601690	25-AUG-86	1330	205	0.096	0.045	L.002	L.002	L.01	L.02
01NB01AF0005	600009	25-MAR-86	1550	205	0.041	0.028	L.002	L.002	L.01	L.02
01NB01AF0005	600274	21-APR-86	1600	205	0.190	0.053	L.002	L.002	L.01	L.02
01NB01AF0005	601138	24-JUN-86	830	205	0.300	0.030	L.002	L.002	L.01	L.02
01NB01AF0005	601694	25-AUG-86	1645	205	0.110	0.038	L.002	L.002	L.01	L.02
01NB01AG0001	503388	25-FEB-86	1500	205	0.050	0.028	L.002	L.002	L.01	L.02
01NB01AG0001	600007	25-MAR-86	1445	205	0.040	0.017	L.002	L.002	L.01	L.02
01NB01AG0001	600272	21-APR-86	1445	205	0.100	0.053	L.002	L.002	L.01	L.02
01NB01AG0001	601137	23-JUN-86	1650	205	0.170	0.040	L.002	L.002	L.01	L.02
01NB01AG0001	601692	25-AUG-86	1545	205	0.110	0.044	L.002	L.002	L.01	L.02

TABLE 7.
NUTRIENTS AND NONFILTERABLE RESIDUE IN WATERS OF THE INTERNATIONAL SAINT JOHN RIVER BASIN SAMPLED DURING 1986.

STATION NO.	SAMPLING DATE	SAMPLING TIME	T. PHOS. (mg/l)	D. PHOS. (mg/l)	NO2+NO3-N (mg/l)	T.N. (mg/l)	D.O.C. (mg/l)	NON-FILT RESIDUE
00NB01AD0001	26-FEB-86	1345	0.007	0.004	0.30	0.41	6.9	L10.
00NB01AD0001	22-APR-86	1230	0.017	0.007	0.15	0.23	7.2	12.5
00NB01AD0001	24-JUN-86	1610	0.011	0.005	0.03	0.13	8.2	L10.
00NB01AD0001	26-AUG-86	1435	0.026	0.007	0.04	0.19	14.0	15.2
00NB01AD0001	26-AUG-86	1431	0.026	0.008	0.02	0.20	16.0	15.2
00NB01AD0001	26-AUG-86	1430	0.025	0.010	0.08	0.20	16.0	16.3
00NB01AD0008	22-APR-86	950	0.024	0.010	0.14	0.22	6.0	12.7
00NB01AD0008	22-APR-86	952	0.024	0.011	0.09	0.17	6.0	
00NB01AD0008	22-APR-86	954	0.025	0.010	0.16	0.23	6.2	
00NB01AD0008	24-JUN-86	1330	0.070	0.060	0.32	0.40	7.1	L10.
00NB01AD0008	24-JUN-86	1332	0.080	0.060	0.30	0.39	6.8	L10.
00NB01AD0008	24-JUN-86	1334	0.070	0.050	0.31	0.39	6.8	L10.
00NB01AD0008	26-AUG-86	1030	0.029	0.011	0.05	0.19	14.0	16.5
00NB01AD0013	26-FEB-86	1300	0.007	0.005	0.26	0.35	6.1	L10.
00NB01AD0013	26-MAR-86	1100	0.008	0.002	0.30	0.37	6.0	L10.0
00NB01AD0013	26-MAR-86	1105	0.007	0.003	0.30	0.37	5.9	
00NB01AD0013	26-MAR-86	1110	0.006	0.002	0.30	0.37	6.0	
00NB01AD0013	22-APR-86	1145	0.015	0.005	0.22	0.30	5.2	L10.
00NB01AD0013	24-JUN-86	1507	0.012	0.003	0.14	0.20	5.6	L10.
00NB01AD0013	24-JUN-86	1509	0.006	0.004	0.13	0.20	5.4	L10.
00NB01AD0013	24-JUN-86	1505	0.008	0.003	0.09	0.15	5.6	L10.
00NB01AD0013	26-AUG-86	1300	0.009	0.004	0.09	0.16	6.6	L10.
00NB01AD0016	26-FEB-86	1030	0.010	0.007	0.19	0.29	4.9	L10.
00NB01AD0016	26-FEB-86	1035	0.011	0.008	0.14	0.26	4.9	
00NB01AD0016	26-FEB-86	1040	0.011	0.007	0.19	0.28	4.8	
00NB01AD0016	26-MAR-86	950	0.012	0.007	0.23	0.31	4.7	L10.0
00NB01AD0016	22-APR-86	930	0.026	0.008	0.20	0.28	4.0	15.4
00NB01AD0016	24-JUN-86	1225	0.016	0.011	0.12	0.18	4.4	L10.
00NB01AD0016	26-AUG-86	1000	0.025	0.010	0.19	0.23	6.5	L10.
00NB01AD0016	26-AUG-86	1010	0.025	0.009	L.01	0.20	6.5	L10.
00NB01AD0016	26-AUG-86	1005	0.027	0.009	0.19	0.24	6.6	L10.
00NB01AF0021	26-FEB-86	915	0.003	0.001	0.34	0.36	1.3	L10.
00NB01AF0021	26-MAR-86	900	0.011	L.001	0.36	0.38	L.5	L10.0
00NB01AF0021	22-APR-86	830	0.230	0.007	0.34	0.39	2.2	61.0
00NB01AF0021	24-JUN-86	1130	0.006	0.003	0.05	0.11	1.8	L10.
00NB01AF0021	26-AUG-86	845	0.006	0.003	0.16	0.24	3.1	L10.
00NB01AF0038	26-FEB-86	955	0.033	0.020	0.20	0.29	11.0	L10.
00NB01AF0038	26-MAR-86	930	0.033	0.022	0.21	0.29	9.8	L10.0
00NB01AF0038	22-APR-86	915	0.030	0.012	0.18	0.24	5.6	19.5
00NB01AF0038	24-JUN-86	1201	0.040	0.016	L.01	L.1	7.8	L10.
00NB01AF0038	25-AUG-86	915	0.027	0.007	0.07	0.20	12.0	12.1
00NB01AG0003	25-FEB-86	1530	0.029	0.024	3.10	2.80	3.0	L10.
00NB01AG0003	25-MAR-86	1510	0.030	0.020	2.80	2.70	2.0	L10.0
00NB01AG0003	21-APR-86	1510	0.029	0.011	1.10	1.10	4.3	L10.
00NB01AG0003	25-JUN-86	1430	0.031	0.015	1.10	1.30	3.9	L10.

TABLE 7.

NUTRIENTS AND NONFILTERABLE RESIDUE IN WATERS OF THE INTERNATIONAL SAINT JOHN RIVER BASIN SAMPLED DURING 1986.

STATION NO.	SAMPLING DATE	SAMPLING TIME	T. PHOS. (mg/l)	D. PHOS. (mg/l)	NO2+NO3-N (mg/l)	T.N. (mg/l)	D.O.C. (mg/l)	NON-FILT RESIDUE
00NB01AG0003	25-AUG-86	1615	0.044	0.015	0.50	0.75	11.0	11.2
00NB01AJ0006	21-APR-86	1345	0.013	0.006	0.64	0.75	3.7	L10.
00NB01AJ0006	21-APR-86	1347	0.014	0.006	0.60	0.70	3.5	
00NB01AJ0006	21-APR-86	1349	0.011	0.006	0.61	0.67	3.2	
00NB01AJ0006	21-MAY-86	1400	0.017					
00NB01AJ0006	22-MAY-86	1400	0.007			0.84	3.5	
00NB01AJ0006	23-MAY-86	1400	0.007			0.75	4.4	
00NB01AJ0006	24-MAY-86	1400	0.008			0.60	7.6	
00NB01AJ0006	25-MAY-86	1400	0.011			0.55	8.4	
00NB01AJ0006	26-MAY-86	1400	0.008			0.52	7.3	
00NB01AJ0006	27-MAY-86	1400	0.011			0.59	6.0	
00NB01AJ0006	28-MAY-86	1400	0.018			0.61	5.5	
00NB01AJ0006	29-MAY-86	1400	0.009			0.66	5.3	
00NB01AJ0006	30-MAY-86	1400	0.011			0.68	4.1	
00NB01AJ0006	31-MAY-86	1400	0.009			0.65	4.7	
00NB01AJ0006	01-JUN-86	1400	0.009			0.77	4.0	
00NB01AJ0006	02-JUN-86	1400	0.009			0.76	4.1	
00NB01AJ0006	03-JUN-86	1400	0.010			0.73	4.1	
00NB01AJ0006	04-JUN-86	1400	0.009			0.78	4.0	
00NB01AJ0006	05-JUN-86	1400	0.010			0.87	3.7	
00NB01AJ0006	06-JUN-86	1400	0.009			0.87	3.4	
00NB01AJ0006	07-JUN-86	1400	0.010			0.87	3.4	
00NB01AJ0006	08-JUN-86	1400	0.013			0.89	3.2	
00NB01AJ0006	09-JUN-86	1400	0.010			0.80	3.8	
00NB01AJ0006	10-JUN-86	1400	0.012			0.72	4.3	
00NB01AJ0006	11-JUN-86	1400	0.014			0.75	4.4	
00NB01AJ0006	12-JUN-86	1400	0.017			0.75	4.0	
00NB01AJ0006	13-JUN-86	1201	0.016			0.97	3.7	
00NB01AJ0006	14-JUN-86	1201	0.017			1.00	3.5	
00NB01AJ0006	15-JUN-86	1201	0.015			0.94	3.5	
00NB01AJ0006	16-JUN-86	1201	0.021			0.99	3.5	
00NB01AJ0006	17-JUN-86	1201	0.020			1.00	3.8	
00NB01AJ0006	18-JUN-86	1201	0.020			0.99	3.8	
00NB01AJ0006	19-JUN-86	1201	0.022			0.94	3.2	
00NB01AJ0006	20-JUN-86	1201	0.014			0.92	3.4	
00NB01AJ0006	21-JUN-86	1201	0.013			0.86	3.5	
00NB01AJ0006	23-JUN-86	1201	0.010			0.74	3.8	
00NB01AJ0006	23-JUN-86	1522	0.013 (0.035)	0.013	0.68	0.77	3.2	L10.
00NB01AJ0006	24-JUN-86	1201	0.013			0.79	3.5	
00NB01AJ0006	25-JUN-86	1201	0.013			0.79	3.6	
00NB01AJ0006	26-JUN-86	1201	0.022			0.70	3.3	
00NB01AJ0006	27-JUN-86	1201	0.015			0.75	3.5	
00NB01AJ0006	28-JUN-86	1201	0.014			0.86	3.2	
00NB01AJ0006	29-JUN-86	1201	0.015			0.82	3.2	
00NB01AJ0006	30-JUN-86	1201	0.015			0.79	3.3	
00NB01AJ0006	01-JUL-86	1201	0.030			0.74	3.8	
00NB01AJ0006	02-JUL-86	1201	0.027			0.78	3.5	
00NB01AJ0006	03-JUL-86	1201	0.027			0.76	3.6	
00NB01AJ0006	04-JUL-86	1201	0.030			0.76	3.6	
00NB01AJ0006	05-JUL-86	1330	0.025			1.20	2.9	

TABLE 7.

NUTRIENTS AND NONFILTERABLE RESIDUE IN WATERS OF THE INTERNATIONAL SAINT JOHN RIVER BASIN SAMPLED DURING 1986.

STATION NO.	SAMPLING DATE	SAMPLING TIME	T. PHOS. (mg/l)	D. PHOS. (mg/l)	NO2+NO3-N (mg/l)	T.N. (mg/l)	D.O.C. (mg/l)	NON-FILT RESIDUE
00NB01AJ0006	06-JUL-86	1330	0.029			1.10	3.0	
00NB01AJ0006	07-JUL-86	1330	0.034					
00NB01AJ0006	17-JUL-86	1330	0.016			0.81	4.4	
00NB01AJ0006	18-JUL-86	1330	0.019			0.91	3.4	
00NB01AJ0006	19-JUL-86	1330	0.022			0.81	3.6	
00NB01AJ0006	20-JUL-86	1330	0.017			0.82	3.4	
00NB01AJ0006	21-JUL-86	1201	0.021			0.75	3.8	
00NB01AJ0006	22-JUL-86	1330	0.021			0.43	4.9	
00NB01AJ0006	23-JUL-86	1330	0.019			0.63	3.5	
00NB01AJ0006	24-JUL-86	1201	0.026			0.60	4.1	
00NB01AJ0006	25-JUL-86	1330	0.029			0.58	3.1	
00NB01AJ0006	26-JUL-86	1330	0.025			0.40	3.6	
00NB01AJ0006	27-JUL-86	1330	0.037			0.58	4.1	
00NB01AJ0006	28-JUL-86	1330	0.046			0.55	4.3	
00NB01AJ0006	29-JUL-86	1330	0.053			0.38	4.2	
00NB01AJ0006	30-JUL-86	1330	0.058			0.32	4.1	
00NB01AJ0006	31-JUL-86	1201	0.036			0.59	3.6	
00NB01AJ0006	01-AUG-86	1201	0.050			0.67	5.7	
00NB01AJ0006	02-AUG-86	1201	0.034			0.69	6.8	
00NB01AJ0006	03-AUG-86	1201	0.017			0.62	7.1	
00NB01AJ0006	04-AUG-86	1201	0.040			0.70	6.7	
00NB01AJ0006	05-AUG-86	1201	0.019			0.52	6.1	
00NB01AJ0006	06-AUG-86	1201	0.017			0.51	5.7	
00NB01AJ0006	07-AUG-86	1201	0.017			0.45	5.1	
00NB01AJ0006	08-AUG-86	1201	0.013			0.54	4.8	
00NB01AJ0006	09-AUG-86	1201	0.022			0.54	8.7	
00NB01AJ0006	10-AUG-86	1201	0.025			0.47	11.0	
00NB01AJ0006	11-AUG-86	1201	0.022			0.34	10.0	
00NB01AJ0006	12-AUG-86	1201	0.014			0.49	9.2	
00NB01AJ0006	13-AUG-86	1201	0.012			0.43	8.1	
00NB01AJ0006	14-AUG-86	1201	0.010			0.44	8.1	
00NB01AJ0006	15-AUG-86	1201	0.012			0.40	6.7	
00NB01AJ0006	16-AUG-86	1201	0.011			0.41	6.4	
00NB01AJ0006	17-AUG-86	1201	0.011			0.51	6.5	
00NB01AJ0006	18-AUG-86	1201	0.012			0.49	7.4	
00NB01AJ0006	20-AUG-86	1201	0.015			0.55	7.8	
00NB01AJ0006	21-AUG-86	1201	0.051			0.48	6.0	
00NB01AJ0006	22-AUG-86	1201	0.010			0.37	4.9	
00NB01AJ0006	23-AUG-86	1201	0.004			0.26	6.9	
00NB01AJ0006	24-AUG-86	1201	0.008			0.36	7.6	
00NB01AJ0006	25-AUG-86	1201	0.011			0.46	8.0	
00NB01AJ0006	25-AUG-86	1510	0.029	0.012	0.24	0.46	11.0	L10.
00NB01AJ0006	26-AUG-86	1201	0.019			0.98	13.0	
00NB01AJ0006	27-AUG-86	1201	0.018			0.53	10.0	
00NB01AJ0006	28-AUG-86	1201	0.014			0.60	8.6	
00NB01AJ0006	29-AUG-86	1201	0.009			0.69	9.2	
00NB01AJ0006	30-AUG-86	1201	0.052			0.58	5.4	
00NB01AJ0006	31-AUG-86	1201	0.015			1.10	4.7	
00NB01AJ0006	01-SEP-86	1201	0.011			0.64	6.3	
00NB01AJ0006	02-SEP-86	1201	0.013			0.58	5.7	
00NB01AJ0006	03-SEP-86	1201				0.71	9.9	

TABLE 7.
NUTRIENTS AND NONFILTERABLE RESIDUE IN WATERS OF
THE INTERNATIONAL SAINT JOHN RIVER BASIN
SAMPLED DURING 1986.

STATION NO.	SAMPLING DATE	SAMPLING TIME	T. PHOS. (mg/l)	D. PHOS. (mg/l)	NO2+NO3-N (mg/l)	T.N. (mg/l)	D.O.C. (mg/l)	NON-FILT RESIDUE
00NB01AJ0029	25-FEB-86	1215	0.014	0.012	0.66	0.70	3.4	L10.
00NB01AJ0029	25-MAR-86	1215	0.016	0.007	0.59	0.65	4.4	L10.0
00NB01AJ0029	25-MAR-86	1220	0.017	0.006	0.61	0.66	4.0	
00NB01AJ0029	25-MAR-86	1225	0.015	0.006	0.61	0.67	4.0	
00NB01AJ0029	21-APR-86	1215	0.010	0.005	0.18	0.36	4.5	L10.
00NB01AJ0029	23-JUN-86	1400	0.013	0.007	0.19	0.29	4.2	L10.
00NB01AJ0029	25-AUG-86	1330	0.023	0.010	0.10	0.25	10.0	L10.
01NB01AF0005	25-MAR-86	1550	0.025	0.016	0.33	0.42	5.6	L10.0
01NB01AF0005	21-APR-86	1600	0.025	0.007	0.18	0.28	5.6	16.6
01NB01AF0005	24-JUN-86	830	0.017	0.007	0.09	0.17	6.8	L10.
01NB01AF0005	25-AUG-86	1645	0.024	0.008	0.11	0.18	9.0	10.4
01NB01AG0001	25-FEB-86	1500	0.046	0.040	0.71	0.71	6.0	L10.
01NB01AG0001	25-MAR-86	1445	0.100	0.062	1.20	0.92	4.6	L10.0
01NB01AG0001	21-APR-86	1445	0.021	0.014	0.19	0.27	5.4	L10.
01NB01AG0001	23-JUN-86	1650	0.037	0.021	0.25	0.33	6.0	L10.
01NB01AG0001	25-AUG-86	1545	0.035	0.016	0.19	0.31	11.0	11.6

TABLE 8
BIG PRESQUE ISLE STREAM AT TRACEY MILLS
AMON DATA SUMMARY
JULY 1 TO AUGUST 31, 1986.

DATE	D.O. %SAT MEAN	D.O. %SAT MIN	D.O. %SAT MAX	pH MEAN	pH MIN	pH MAX
01-JUL-86	152.73	98.81	238.93	8.29	7.97	8.61
02-JUL-86	134.60	102.93	170.81	8.25	7.90	8.62
03-JUL-86	146.13	100.35	249.01	7.57	6.72	8.31
04-JUL-86	137.49	95.61	189.33	8.04	6.67	8.62
05-JUL-86	117.89	88.07	154.96	8.31	8.03	8.58
06-JUL-86	122.69	89.79	164.89	8.35	8.06	8.65
07-JUL-86	101.36	85.78	129.50	8.27	8.04	8.56
08-JUL-86	132.70	76.60	249.76	8.38	8.09	8.67
09-JUL-86	136.66	96.39	192.51	8.36	8.07	8.69
10-JUL-86	109.19	84.17	136.67	8.44	8.18	8.74
11-JUL-86	112.44	83.45	152.32	8.52	8.24	8.78
12-JUL-86	113.80	79.79	144.04	8.57	8.26	8.77
13-JUL-86	123.55	85.33	151.99	8.64	8.39	8.76
14-JUL-86	112.34	89.54	140.64	8.41	8.16	8.71
15-JUL-86	133.38	109.26	177.75	8.44	8.19	8.76
16-JUL-86	163.44	112.45	271.10	8.49	8.18	8.82
17-JUL-86	193.03	129.50	242.17	8.63	8.26	8.78
18-JUL-86	134.53	118.74	168.86	8.30	8.14	8.64
19-JUL-86						
20-JUL-86	241.18	127.59	402.81	8.33	7.89	8.80
21-JUL-86	192.29	122.64	293.98	7.68	7.41	7.95
22-JUL-86	154.90	90.52	279.59	8.37	7.69	8.79
23-JUL-86	140.59	78.87	221.55	8.45	8.08	8.78
24-JUL-86	115.03	69.89	160.01	8.49	8.09	8.77
25-JUL-86	67.55	48.28	111.92	8.34	8.03	8.71
26-JUL-86						
27-JUL-86	165.23	99.07	205.14	8.64	8.20	8.85
28-JUL-86	130.06	80.73	190.92	8.46	8.04	8.86
29-JUL-86	136.04	95.10	195.27	8.46	8.08	8.82
30-JUL-86	112.80	73.94	170.50	8.48	8.00	9.04
31-JUL-86	131.55	105.58	169.73	8.63	8.35	8.96
01-AUG-86	116.79	111.55	122.70	8.51	8.36	8.73
02-AUG-86						
03-AUG-86	93.99	86.03	103.56	8.47	8.16	8.70
04-AUG-86	97.64	83.93	107.96	8.52	8.09	9.02
05-AUG-86	79.54	59.84	102.22	8.56	8.08	8.96
06-AUG-86	72.89	51.19	102.29	8.56	8.11	9.04
07-AUG-86	63.21	53.03	77.52	7.73	7.33	8.16
08-AUG-86	111.21	72.81	137.27	8.39	8.01	8.78
09-AUG-86						
10-AUG-86						
11-AUG-86	76.70	68.53	89.15	7.99	7.80	8.27
12-AUG-86	82.18	70.47	100.56	8.22	7.92	8.74
13-AUG-86	90.60	63.05	129.90	8.39	7.96	8.73
14-AUG-86	107.35	75.98	142.34	8.42	7.92	8.91
15-AUG-86	91.88	76.62	116.77	8.34	7.92	8.94
16-AUG-86	87.46	70.56	106.02	8.21	7.92	8.49
17-AUG-86	110.75	83.69	142.05	8.32	7.88	8.87
18-AUG-86	97.59	78.20	121.81	8.30	7.88	8.80
19-AUG-86	103.97	75.44	128.30	8.57	8.06	8.86
20-AUG-86	95.78	73.98	126.81	8.52	7.99	8.90

TABLE 8
BIG PRESQUE ISLE STREAM AT TRACEY MILLS
AWQM DATA SUMMARY
JULY 1 TO AUGUST 31, 1986.

DATE	D.O. %SAT MEAN	D.O. %SAT MIN	D.O. %SAT MAX	pH MEAN	pH MIN	pH MAX
21-AUG-86	74.31	66.72	94.48	8.39	8.04	8.80
22-AUG-86	120.79	81.90	151.08	8.58	7.98	8.88
23-AUG-86	99.31	75.02	133.22	8.47	8.02	8.20
24-AUG-86	87.75	70.95	108.45	8.10	7.91	8.43
25-AUG-86	96.49	81.52	103.66	7.88	7.77	7.99
26-AUG-86	100.51	83.92	115.41	8.13	7.76	8.47
27-AUG-86	84.79	75.66	92.08	7.84	7.69	8.08
28-AUG-86	90.94	77.19	107.87	8.20	7.80	8.63
29-AUG-86	89.47	76.54	113.79	8.24	7.90	8.71
30-AUG-86	94.87	78.44	114.53	8.32	7.91	8.67
31-AUG-86	94.98	76.91	120.57	8.28	7.87	8.77

TABLE 8
BIG PRESQUE ISLE STREAM AT TRACEY MILLS
AWQM DATA SUMMARY
JULY 1 TO AUGUST 31, 1986.

DATE	WATER T MEAN	WATER T MIN	WATER T MAX	PAR MEAN	PAR MIN	PAR MAX	D.O. MG/L MEAN	D.O. MG/L MIN	D.O. MG/L MAX
01-JUL-86	19.37	15.9	24.3	352.0	0	1510	8.84	6.9	11.1
02-JUL-86	18.78	16.2	23.4	202.0	0	716	8.60	6.7	10.8
03-JUL-86	18.83	14.6	24.8	120.0	0	503	8.43	7.3	9.8
04-JUL-86	20.25	17.3	24.1	311.0	0	1156	7.75	5.9	9.8
05-JUL-86	19.04	17.1	21.0	193.0	0	961	7.37	6.0	9.2
06-JUL-86	18.43	15.5	21.0	262.0	0	939	7.94	6.4	9.8
07-JUL-86	17.38	16.0	20.4	72.0	0	239	7.17	5.8	8.8
08-JUL-86	18.79	15.7	25.1	301.0	0	1502	7.51	6.0	9.7
09-JUL-86	20.81	18.4	24.0	210.0	0	1211	7.35	5.8	9.5
10-JUL-86	17.91	15.7	21.5	245.0	0	781	7.41	6.0	9.2
11-JUL-86	17.22	15.1	20.1	276.0	0	916	7.90	6.3	9.4
12-JUL-86	18.51	16.6	19.8	201.0	0	946	7.40	5.9	8.9
13-JUL-86	19.94	18.3	21.4	214.0	0	879	7.24	5.7	8.6
14-JUL-86	18.08	16.2	20.7	59.0	0	208	7.69	5.4	10.4
15-JUL-86	16.69	15.0	19.8	226.0	0	1315	9.69	8.7	11.1
16-JUL-86	18.90	15.1	24.8	335.0	0	1514	9.73	8.2	11.5
17-JUL-86	22.83	20.2	24.6	346.0	0	1516	8.59	7.0	10.7
18-JUL-86	20.52	18.8	23.3	5.0	0	40	7.53	6.7	9.2
19-JUL-86									
20-JUL-86	22.64	18.9	27.2	465.0	0	1519	9.56	8.0	10.7
21-JUL-86	23.98	21.4	26.5	319.0	0	1481	7.23	5.7	9.0
22-JUL-86	21.51	17.9	26.6	366.0	0	1519	7.11	5.8	8.6
23-JUL-86	22.56	19.2	26.1	304.0	0	1460	6.06	4.6	8.1
24-JUL-86	21.68	17.6	24.9	360.0	0	1513	5.55	4.2	7.0
25-JUL-86	22.54	20.8	24.8	21.0	0	213	3.05	2.6	4.0
26-JUL-86									
27-JUL-86	23.49	20.1	25.5	635.0	0	1386	6.62	5.8	7.3
28-JUL-86	21.90	20.0	24.2	182.0	0	701	6.32	4.5	9.0
29-JUL-86	21.19	19.2	22.9	253.0	0	1172	7.09	5.5	9.4
30-JUL-86	19.65	18.3	22.5	101.0	0	451	6.89	4.4	11.0
31-JUL-86	16.49	15.6	18.1	53.0	0	204	9.87	7.9	12.9
01-AUG-86	15.78	15.6	16.2	3.0	0	4	11.05	10.6	11.5
02-AUG-86									
03-AUG-86	17.78	17.1	18.7	146.0	0	349	8.50	7.9	9.3
04-AUG-86	19.94	17.2	24.9	279.0	0	1349	8.44	6.7	9.7
05-AUG-86	20.58	17.1	24.0	284.0	0	1475	6.77	5.2	8.6
06-AUG-86	21.63	17.7	25.4	321.0	0	1270	6.04	4.4	8.1
07-AUG-86	22.08	19.9	24.9	15.4	0	151	5.20	4.5	6.1
08-AUG-86	20.12	19.1	21.8	105.0	-0	601	9.57	6.1	11.8
09-AUG-86									
10-AUG-86									
11-AUG-86	18.25	17.6	18.8	59.0	0	149	6.87	6.1	7.9
12-AUG-86	17.59	14.9	20.6	117.0	0	488	7.45	6.4	8.7
13-AUG-86	18.23	14.2	22.2	143.0	0	687	8.05	5.7	10.7
14-AUG-86	18.95	14.8	24.1	291.0	0	1525	9.41	6.9	11.7
15-AUG-86	19.27	16.2	23.2	102.0	0	766	8.05	6.6	10.4
16-AUG-86	18.41	17.6	20.6	56.0	0	168	7.82	6.0	9.5
17-AUG-86	18.92	17.3	22.0	175.0	0	623	9.72	7.6	11.9
18-AUG-86	19.06	18.0	21.4	93.0	0	290	8.58	6.9	10.7
19-AUG-86	19.41	18.6	20.2	174.0	0	738	9.06	6.7	11.1
20-AUG-86	18.81	16.7	21.4	149.0	0	587	8.43	6.6	10.9

TABLE 8
BIG PRESQUE ISLE STREAM AT TRACEY MILLS
AMOM DATA SUMMARY
JULY 1 TO AUGUST 31, 1986.

DATE	WATER T MEAN	WATER T MIN	WATER T MAX	PAR MEAN	PAR MIN	PAR MAX	D.O. MG/L MEAN	D.O. MG/L MIN	D.O. MG/L MAX
21-AUG-86	18.90	17.3	20.8	0.0	0	0	6.54	5.9	8.0
22-AUG-86	20.87	18.9	22.3	423.0	0	1242	10.15	7.1	12.6
23-AUG-86	18.04	14.4	21.8	326.0	0	1514	8.87	6.8	11.4
24-AUG-86	15.67	13.7	19.1	59.0	0	193	8.34	6.4	10.7
25-AUG-86	13.44	12.9	14.0	112.0	0	421	9.63	8.1	10.3
26-AUG-86	15.12	12.7	17.4	328.0	0	1501	9.61	8.5	10.8
27-AUG-86	14.05	13.3	16.0	40.0	0	136	8.34	7.5	9.1
28-AUG-86	13.71	12.6	15.3	231.0	0	799	9.00	7.8	10.4
29-AUG-86	12.17	9.8	14.6	122.0	0	434	9.18	7.9	11.2
30-AUG-86	12.01	9.0	14.1	252.0	0	1356	9.77	8.3	11.3
31-AUG-86	13.99	11.3	18.0	300.0	0	1502	9.31	7.9	11.1